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Editorial.

THE PUPILAGE QUESTION.

Now that the schools are reopening and the students are returning to the theoretical part of their professional work, it may not be out of place to wonder how many of them have spent their recent vacation in gaining practical knowledge of the details of the profession of which they are shortly hoping to become members. Until a few years ago it was the usual custom for a youth to spend at least twelve months (many spent two years) with a practitioner in some large town or country district, a clause usually being inserted in the indentures that another year should be completed during the college vacations; and there is no doubt that the men were the better for the training they received. It is true that they were apt to obtain some ideas which had to be reconstructed, and perhaps forgotten, but in the main their pupilage was beneficial. Taken at a period when their enthusiasm for professional work was at its highest and at an age when their chance of receiving impressions at its best, they gradually learnt all about the conditions of animals in health and, what is equally essential to success, the way to manage unreasonable clients and the hundred and one details connected with the conduct of a successful practice. Until the Colleges have continual access to large farms in connection with the courses of study it will be impossible for a student to learn, without going into country practice, anything more than a very superficial idea of the habits of cattle, sheep, and pigs. Established as each College is, in the

heart of a great city, the bulk of the patients must of necessity be horses and dogs, and the student who wishes to improve his practical education must either do it during the vacations or after he has obtained a diploma, which implies that he is fully qualified to practise the science and art of veterinary surgery. Besides which, most important of all, he has no opportunity of dealing directly with the owners or clients. To idle away the time between the sessions in a manner which is incorrectly designated "resting" is a mistaken policy, and unquestionably accounts for the preference many practitioners still have for an unqualified assistant whose only recommendation is his practical experience. Even if only the three months' vacation of each year is spent in a busy town or country practice a receptive and earnest student will learn much ; he will take back some practical ideas which he can endeavour to reconcile with his College theories, and at all events he will have a distinct foundation upon which to commence the building up of the practical knowledge he hopes to acquire during the assistantship which he takes after leaving College, in the hope that as soon as he feels capable he may undertake the responsibilities of a practice of his own. To set up in practice for one's self immediately after obtaining the diploma, unless a practical knowledge has been acquired, is only to court disaster in the vast majority of cases, and to only commence to acquire this practical knowledge when possessing the magic M.R.C.V.S. letters is sure to lead to many mistakes which are excusable in a pupil but only lead to ridicule, or perhaps even legal trouble, when committed by a qualified man.

Clinical Articles.

DOURINE AND ITS TREATMENT.

BY MAJOR H. T. PEASE, PRINCIPAL, PUNJAB VETERINARY COLLEGE.

THE subject of the treatment of dourine by the subcutaneous injection of cacodylate of soda has already been noticed by me in a previous issue of this Journal, and since that time another article has appeared in which the author states that cacodylate has a good effect.

In the *Rec. de Méd. Vét.* for April 15, 1904, E. Marchal, Veterinary Officer at the Remount Depôt at Constantine, states that experience has shown that the cacodylates will cure dourine. He has carried out treatment of horses suffering by the subcutaneous injection of 1 gramme of cacodylate of soda in 5 to 10 cubic centimetres of distilled and boiled water. The inoculations have to be carried out for five days in succession and then followed by a rest of seven days.

He, however, states that this rule is not absolute, but that the medication may be graduated according to the patients and the severity of the morbid processes. After his first experiences he came to the conclusion that it was better, even in the treatment of recent cases, to practise injections during five consecutive days and then allow an interval of another five. In severe cases, however, as much as 1, 2, or even 3 grammes *per diem*, properly diluted, may be given at intervals. We are directed to base our doses on the condition of the animal and the severity of the infection, reducing to the ordinary dose when the weighing machine shows improvement in weight. The food and hygiene should at the same time, of course, be attended to, and when the horse begins to gain strength we should give progressive exercise. It is impossible at present to say how long it would be necessary to prolong the treatment in order to ensure absolute cure. In certain stallions the malady rapidly disappears, whilst in others, clinically and microscopically diagnosed, it appears to lie dormant, to again manifest itself by more severe symptoms at a later date. The following cases are quoted by Marchal:—

CASE I.

The stallion "Khelifa," born in 1898, was treated twenty-four days after the first symptom of dourine manifested itself, and appeared cured in November, 1902. In January, 1903, however, lameness of the off hind-leg appeared, together with weakness of the loins. The cacodylate treatment was resumed. From January 10 the body-weight, which had oscillated between 400 and 420 kilos., began to decrease, despite a very good appetite, and fell to 390 kilos. on February 21, and 320 kilos. on May 21. The emaciation progressed, whilst at the same time weakness of the loins increased, and on May 17 the animal was incapable of supporting the weight of a rider and had difficulty in standing. He was weighed on June 13, and was found to be 300 kilos., and this had fallen by August 1 to 275 kilos. The animal was little better than a bag of bones and could only walk with difficulty. After August 22 he walked better and seemed stronger, although not putting on flesh. He soon, however, began to

pick up weight, and weighed 300 kilos. on October 10, and in November 330 and 340 kilos. The walk was quite normal, and the horse had undergone a complete transformation in his general condition.

This case was considered as cured on November 7, and the treatment had been stopped in consequence. The conclusion as to cure has been based not only on the disappearance of the symptoms and the good condition of the animal, but also on the fact that an intraperitoneal inoculation of the rabbit with a massive dose of blood (5 cc.) from the jugular has been negative.

Case II.

The stallion "Notus," 7 years old, was attacked with dourine on August 1, 1902, and put under cacodylate treatment sixty-one days after the first symptom. He showed no improvement from October 10 till December 10. His weight was 410 kilos. when attacked, and by January 31, 1903, he weighed only 270 kilos.; but from the beginning of February his general condition began to improve, local and general symptoms disappeared, the strength returned, and on February 7 he weighed 305 kilos. Improvement continued until May, when he weighed 365 kilos. Treatment was discontinued on May 27, and the animal left the infirmary on June 17 and joined the ranks of the 3rd Chasseurs d'Afrique. Before he was handed over a male rabbit received an intraperitoneal inoculation of blood from the jugular without any reaction. The horse has since been trained and ridden daily as a troop horse. He has also been through the manœuvres at Constantine, and up to date has shown no further symptom of the disease.

Case III.

Stallion "Yacoub," born in 1897, attacked with dourine and treated fifty-five days after the first manifestation of symptoms (dates not given). Since December 7 appears cured and in the best of health. Castrated February 28, and handed over to the 3rd Chasseurs d'Afrique on April 28, and has since been through manœuvres. returning in excellent health. There is no doubt that he is thoroughly cured. Before handing over, an intraperitoneal inoculation of a rabbit with his blood was negative.

Case IV.

Stallion "Neophyte II.," born in 1894, treated forty-six days after the first symptoms of dourine appeared, and was considered to be perfectly well on December 16, 1902. This animal was castrated on February 25, 1903, and was handed over to the 3rd Chasseurs d'Afrique on April 28, taking part in manœuvres, and remaining in excellent health.

In order to ascertain whether treatment by cacodylate of soda used in the manner directed by Marchal would be really efficacious in the treatment of dourine as it occurs in India, I decided to select a recently infected pony measuring 14 hands, and in the early patch stage of dourine, so that it would be possible to decide what (if any) action the drug would have on the trypanosoma and the eruption of patches.

It was hoped that after a few months' use at longest the organism would be destroyed and the patches cease. A perusal of the case will show that the drug had apparently had no beneficial effect on the course of the disease after six and a half months' treatment, as patches were still appearing on the skin and trypanosomata found in them. The drug was pushed at times as far as was deemed advisable, but no benefit was observed at such times. During the time the animal was under treatment he received proper diet and exercise. The conclusion arrived at is that the drug has no appreciable effect on the disease during its earlier stages. In animals which are recovering it proves useful as a tonic and alterative, improving the appetite and condition. It does not appear to have nearly so powerful an action as arsenic has. I quote the case at some length to plainly show the result of the treatment. It has been found in India, where dourine is an old disease, that it is not nearly so fatal in its consequences as it appears to be in Europe, and that although some animals die from it, the majority recover after having been very ill, some even remaining in pretty good condition and throwing off the disease with little difficulty. I have seen quite a considerable number of horses and mares so recover after periods of illness varying from five to fourteen months. I suggest that Marchal's cases probably belonged to this class, and that the cacodylate acted as a tonic and alterative, and not as a parasiticide, in them.

Record's Case.

Record, Arab pony stallion, first found affected with dourine at Mursan, in the Aligarh district, and admitted to the Punjab Veterinary College Hospital on October 27, 1904, with the classical symptoms, such as swelling of the sheath and penis, typical patches on the skin, in the blood from which the *Trypanosoma equiperdum* could be readily demonstrated. There was subacute inflammation of the spermatic cords and testicles, and considerable pain. During December the effect of serum from a highly immune horse was used in treatment, but without appreciable result.

On December 19 it was decided to give the cacodylate of soda treatment, recommended by Marchal, a fair trial with a view to ascertaining whether the drug had any destructive or inhibitory effect on the organism causing dourine. One gramme of cacodylate dissolved in boiled distilled water was given subcutaneously. There were on this date two plaques on the right hip, and the parasites were fairly numerous in blood from them.

December 20.—A patch was distinct on left ribs. Injected 1 gramme 4 grains cacodylate.

December 21.—Patches disappeared, no organisms. Injected cacodylate, 1 gramme 8 grains.

December 22.—Cacodylate, 2 grammes.

December 23.—Cacodylate, 2 grammes.

December 24.—Discontinued the injection.

December 28.—Two patches, containing trypanosomata, appeared on front of left shoulder.

December 29.—Cacodylate, 1 gramme.

XUM

December 30.—Cacodylate, 1 gramme 4 grains. Both patches are still present and contain organisms.

December 31.—One new plaque on right chest. Cacodylate, 1 gramme 8 grains.

January 1, 1905.—Patches still remain and organisms present. Dose, 2 grammes.

January 2.—Patches smaller, but organism still present. Two grammes cacodylate given.

January 3.—One new patch on the left side of the belly. Discontinued the drug.

January 7.—A new plaque with organisms.

January 8.—Cacodylate, 1½ grains given.

January 9.—Dose increased to 1 gramme 9 grains.

January 10.—Dose, 2 grammes.

January 11.—Dose, 2 grammes 4 grains.

January 12.—Dose, 2 grammes 8 grains. One new patch on left ribs.

January 13.—Discontinued the drug. The horse is losing condition, the gait is uncertain with the hind-legs. He is in a good deal of pain from the chronic orchitis and lies down all day long. Three new patches have appeared on the left hip and the blood taken from them contains organisms.

January 15.—A fresh plaque on the right shoulder with the organism present.

January 16.—Two new plaques on right neck; organisms present.

January 19 to 22.—The cacodylate was given in daily increasing doses, from 1½ grammes to 2½ grammes.

January 23.—Drug discontinued.

January 24.—A new patch appeared on the left buttock and organisms were present in it. The horse looks brighter and feeds better.

January 26.—Three new patches, with organisms, on body. Cacodylate, 2 grammes. The animal's condition is improving.

January 27.—Same as yesterday.

January 28.—The body weight is now 738 lbs., an increase of 42 lbs. since admission. Cacodylate, 2 grammes.

January 29.—Dose increased by 8 grains to-day.

February 1.—Cacodylate, 2½ grammes for the last three days. Old patches disappeared.

February 2.—All the old patches gone; discontinued the drug till the 6th.

February 5.—One new patch, with organisms, on neck.

February 6.—Cacodylate of soda, 2 grammes.

February 7.—A new patch; 2 grammes cacodylate.

February 11.—The dose has been increased gradually to 2½ grammes. No patches.

February 12.—Discontinued the drug for five days.

February 17.—There are three new patches on belly and organisms present. Cacodylate, 2 grammes.

February 18 to 25.—Cacodylate, 2½ grammes daily. One patch on left flank on the 23rd, and disappeared on the 25th.

February 26 to March 1.—There seems some improvement in general condition, but new patches appeared on the 28th.

March 2 to 10.—The drug was used in doses of from 1½ to 2½ grammes on the 6th, and continued at that dose on the 11th, when it was discontinued. Two patches appeared on the 3rd; three on the 5th; three on the 6th; one on the 8th; and two on the 9th.

March 11 to 15.—No change; no patches on the later date. Cacodylate, 1½ grammes given.

March 16.—A new patch appeared and organisms present.

March 17.—Cacodylate still 1½ grammes given.

March 18 to 20.—Two-gramme doses given.

March 21 and 22.—Two and a half grammes.

March 23.—Discontinued for five days.

March 24.—Three new patches.

March 29.—Animal looks a little stronger and in better condition. The orchitis, however, continues, and large patches of leucoderma have appeared over sheath and scrotum. Gave 1½ grammes.

March 30.—Eight new patches have appeared to-day. Cacodylate, 1½ grammes.

March 31.—Two fresh plaques containing organisms. Two grammes of cacodylate.

April 1.—No new patch. Two grammes cacodylate.

April 2.—A fresh plaque on loin. Drug, 2 grammes.

April 3.—Three new patches to-day. Drug, 2 grammes.

April 6.—All the patches have disappeared. Two grammes of cacodylate of soda have been given daily up to date. The horse seems stronger and in better condition, but is still poor.

April 11.—Cacodylate of soda, 1½ grammes.

April 12.—One patch containing organisms appeared on right belly. Cacodylate, 1½ grammes.

April 13.—One fresh plaque, with organisms, on left flank. Slight œdema under belly and on sheath.

April 14.—Two new patches containing organisms to-day, one on the right of the neck and the other on the right of the ribs. Cacodylate of soda discontinued.

April 20.—Two patches on left side of body, organisms not found.

April 22.—Cacodylate of soda, 1½ grammes.

April 26.—Cacodylate has been continued up to date, but to-day three new plaques appeared; two on the withers and one on right side of body. Trypansoma is present in blood from the patches. Two grammes of cacodylate given.

April 27.—Two and a half grammes of cacodylate given. Four new patches appeared to-day and trypanosoma was present.

April 28.—Two and a half grammes of cacodylate. Two new patches, in blood from which trypanosoma was present.

April 29.—Two and a half grammes of cacodylate. One new patch appeared to-day.

April 30.—Drug discontinued.

May 1.—Two new patches with organisms.

May 2.—Body weight 700 lbs. There are three new patches to-day.

May 3.—One fresh plaque with organisms.

May 4.—Two new patches with organisms.

May 5.—One new patch to-day.

May 6.—Cacodylate, 2 grammes.

May 7.—Cacodylate, 2½ grammes. There are five new patches and the organism is present.
May 8.—Cacodylate, 2½ grammes. One new patch.
May 9.—Cacodylate, 3 grammes. Two new patches.
May 10.—Cacodylate, 3 grammes.
May 11.—Cacodylate, 3 grammes. One new patch containing organisms.
May 12.—Cacodylate of soda, 3 grammes.
May 13.—One new patch. Cacodylate discontinued.
May 14.—Three new patches.
May 18.—One new patch. Two grammes cacodylate.
May 19.—Cacodylate increased to 2½ grammes.
May 20.—Cacodylate increased to 3 grammes.
May 21.—One new patch. Cacodylate, 3 grammes.
May 23.—One new patch. Cacodylate, 3 grammes.
May 24.—Two new patches. Cacodylate, 3 grammes.
May 25.—Cacodylate, 4 grammes.
May 26.—Cacodylate, 4 grammes. Three new patches.
May 27.—Organisms are still present in old patch. Discontinued cacodylate.
May 29.—Four new patches.
May 30.—One new patch.
May 31.—One new patch.
June 1 —Two grammes cacodylate of soda.
June 2.—Three grammes cacodylate of soda. One new patch.
June 3.—Two new patches. Cacodylate, 3 grammes.
June 4.—Two new patches. Three grammes of cacodylate.
June 5.—Cacodylate of soda, 4 grammes.
June 6.—One new patch. Four grammes cacodylate.
June 7.—One new patch. Four grammes cacodylate.
June 8.—One new patch. Four grammes cacodylate.
June 9.—Four grammes cacodylate.
June 10.—Discontinued cacodylate. Three old patches present.
June 13.—One new patch.
June 14.—One new patch; organisms present. The horse is stronger, but there has been no appreciable effect on the course of the disease which could be attributable to the administration of the drug.

NOTES ON AN OUTBREAK OF ANTHRAX.

BY LIEUTENANT T. A. NICHOLAS, ARMY VETERINARY DEPARTMENT, BANGALOR, INDIA.

THE following outbreak occurred amongst the horses of the 12th Battery of the Royal Field Artillery, stationed at Bangalor. On June 3 a horse was admitted into hospital about mid-day with a temperature of 102·2° and showing symptoms of bilious fever. At 5 p.m. there was a swelling in the region of the throat and the case was at once isolated as suspicious of anthrax. On the following day this swelling had increased and the temperature was 103°. The horse was not feeding well and at 5 o'clock in the evening there was a yellow gelatinous discharge from the off nostril. The respirations

were hurried and the animal looked very depressed. On June 5 the symptoms became more marked, the patient became delirious and died about 6 o'clock. Just before death there was a twitching of the muscles of the shoulder, particularly on the off side.

Microscopical examination of the body revealed anthrax bacilli.

Case 2 was admitted into hospital on June 6, at 6 a.m., with a temperature of 106·2°. The horse was first noticed to be breathing heavily when at the riding school in the morning, and was at once sent to hospital and isolated. About mid-day there was a slight yellow gelatinous discharge from the off nostril.

On the following day the temperature was 105·2° and there was a slight swelling in the region of the throat. This extended, on the 8th, towards the near nostril. The appetite was capricious, as the animal would eat a little hay and lucerne but would not touch bran. On the 9th the breathing was somewhat hurried and the swelling had increased towards the wing of the nostril. There was a yellow gelatinous discharge from both nostrils and frothing at the mouth. The temperature was 106° and the animal refused its food. On the following day (the 10th) there was a large swelling on the throat; the temperature was 103·4°, breathing was very laboured, and there was a yellow gelatinous discharge from both nostrils. The horse died about 3 p.m.

Case 3 was admitted about noon of the 13th. The temperature on that day ranged between 104·2° and 106·4°. On the 14th two small swellings were noticed on the lower extremities of the last two ribs, the temperature was 104°, the horse was depressed and eating very little. At 4.15 the body was covered with patchy sweats, the ears and legs were very cold, and the horse showed signs of abdominal pain. After staggering round the box for a few times and showing the same peculiar quivering of the muscles of the shoulder as in Case 1, the horse fell down and died.

Microscopical examination revealed without any difficulty the presence of anthrax bacilli, the blood being of the characteristic black and tarry appearance.

IMPACTION OF THE COLON IN A DOG.

BY F. H. RIDLER, M.R.C.V.S., AND T. HODGINS, M.R.C.V.S., KENSINGTON, W.

Subject.—White male poodle, 6 years old, owned by a professional gentleman.

Previous History.—Had been abroad for a considerable period and was a great favourite, consequently had been injudiciously fed. Previous to present attack, the owner stated, the patient has never ailed anything.

History of Present Attack.—Three days before coming under our observation the owner had noticed that the animal, although making repeated attempts at defæcation, passed nothing. On making enquiries as to its recent diet, he ascertained that a day or two previously the poodle had been given a considerable number of chop bones. These he had crunched up and swallowed. As an aperient

his master had given a purgative dose of calomel 2 grs. and jalapin 2 grs. This not having the desired effect, several enemas were given, but nothing was passed.

As the symptoms became more grave, the owner considered laparotomy was necessary and the patient was passed on to our care. The symptoms exhibited then were as follows: The dog had an anxious expression after walking a few yards, and would put himself into the position for defæcation. He would remain in this attitude for two or three minutes, making repeated straining efforts, when a considerable quantity (about a tea-cupful) of bloody discharge would come away. He would then lie down for about half an hour, when he would go through the same attempts at straining.

Temperature 104° F., pulse 100, mucous membranes injected, breathing slightly increased, refusal of food, but would drink quantities of cold water, and when in the recumbent position would lie as if the pressure of his bed against the abdomen was a great relief to him.

On manual examination of the abdomen one could feel a long, hard, sausage-shaped lump, about six inches long, extending in the median line of the body about two inches above the floor of the abdomen anterior from the region of the epigastrium to near the pelvic orifice. It was significant because of its great hardness, just as if the colon had been filled with cement which had been allowed to harden.

Digital examination of the rectum revealed very little except a fœtid bloody discharge.

Treatment. First day of treatment, fourth day of illness.—Mist. bismuth co. Mackey ℥xxx. every four hours, and after two doses of the above had been given, ol ricini ℥j. was administered. Warm chinosol enemas, gr i. to ℥j., were two or three times a day, previous to the operation, thrown up into the rectum. The patient's strength was maintained with small quantities of cold nutritive beef-juices frequently administered, and occasionally small doses of brandy.

Second day of treatment, fifth day of illness.—No real improvement. Patient much about the same. Temperature, pulse and respiration much about the same. Treatment continued as above with another dose of ol. ricini. A 9-inch blunt-edged curette was passed into the rectum and just touched the posterior end of the impacted bowel, but owing to the elasticity of the bowel behind the impacted portion, as attempts were made to break up the impaction so the impacted bowel was pushed forward. Only very small quantities of partially decomposed bone could be got away on several attempts in using the curette, as stated above, with subsequent washings out with Higginson syringe with extension pipe adjusted.

Third day of treatment, sixth day of illness.—Patient no better. Symptoms more aggravated, although only enemas and above treatment were persisted in. With the owner's consent, it was decided to open the abdomen and endeavour by massage to the impacted bowel to break down the mass.

The operation was carried out in the usual way under chloroform, using strict aseptic surgery. The impacted portion was kneaded first at each end. Chinosol enemas were thrown up into the bowel, and the curette passed *per rectum* proved invaluable in breaking

down a great quantity of the impacted mass, which was subsequently washed away with weak antiseptic enema.

The operation occupied two full hours, the left hand of the operator being in the abdominal cavity kneading the bowel for quite one hour. It was an impossibility to move the impacted bowel out of the abdominal cavity. The abdominal wound was sutured with silk-worm gut with a covering of iodoform collodion.

Subsequent Treatment.—For five days after the animal lay in a prostrate condition, being unable to stand, and having no desire to take food, lapping only small quantities of iced water. During this period the temperature kept about 104° F., pulse 120.

Stimulants were administered in small quantities and a daily enema persisted in, which brought away large quantities of partially decomposed bones mixed with hair. On the fifth day the patient showed a decided improvement; took a little scraped raw mutton, and subsequently made an uninterrupted recovery.

AN EQUINE HERMAPHRODITE.

BY R. GRANVILLE HASKELL, M.R.C.V.S., CAXTON.

I HAVE recently met with two interesting cases of the above, and have managed to secure photographs which I thought might be of interest for publication.

I have not had the opportunity of operating or of seeing what organs may be hidden internally, so that it is possible that I ought perhaps to term them cases of arrested development rather than true hermaphrodites.

CASE A.—This animal was a two-year-old bay cart-horse, at one time used for the plough, but now employed at draught. It is an excellent worker and quiet with other horses; if kept at work, is very little trouble. If allowed to remain idle, however, it gets partial erections, but shows no more marked desire. Fig. 2 shows the "penis" in a condition of partial erection, the tail being held to one side. If the tail is allowed to hang normally, then the "penis" protrudes to one side of it, in a condition of erection, at nearly a right angle, and in micturating the stream of urine is projected straight backwards. The animal has well-developed mammary glands and teats. No trace of a testicle can be felt in the vaginal region.

CASE B.—A two-year-old chestnut cart-colt. This animal shows much the same external appearances as in case A, except that the bulbous enlargement at the base of the glans is rather larger. The mammary glands and teats as in the virgin mare. This animal differs from the preceding by showing very strong male proclivities, and cannot be left with other horses, male or female, becoming quite unmanageable in their company. No testicles can be detected, but in this case it is probable they are better developed than in case A. The colt is well formed, and should make a useful animal, if cryptor-ovariectomy proved successful.

In neither of these cases could a history of their progenitors be secured.

FIG. 1.—The external genital organs from Case A.

FIG. 2.—The abnormally small penis in a state of erection.

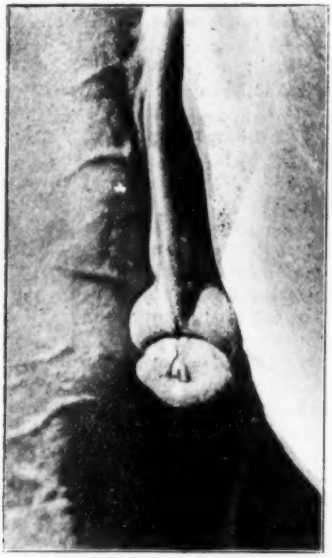

FIG. 3.—The external genital organs from Case B.

SOME CLINICAL NOTES.

BY T. FOULKES, M.R.C.V.S., BROMYARD.

A Delayed Parturition.

A short time ago I was sent for in a hurry to see a Hereford cow which had calved three weeks before. The owner did not see any sign of the after-birth, and she had now completely lost her appetite and was straining.

Thinking that the after-birth required to be removed, he sent for me to do this. Upon examination I found that she had a calf in the right cornu, and that the body of the womb had partially contracted, making delivery very difficult.

After some manipulation I managed to get the calf away. The after-treatment consisted in syringing with antiseptics, and the patient did well, being sold a month later.

I think the case of interest, on account of the length of time which elapsed between the first and second delivery.

Torsion of the Uterus.

By a curious coincidence I have within three months had three cases of torsion of the uterus in the cow. Case A was a shorthorn with her third calf. She had been in labour for thirty-six hours, and when I examined her the first time, at 2 a.m., I thought that she was not ready for calving.

About eight or nine hours later I examined her again, and distinctly found that the cause of the trouble was a twist of the neck of the womb. The cow was put down and turned over three times in the usual way, my hand and arm being held in the passage. She was delivered of a live calf, and both cow and calf did well.

Case B was a heifer with her first calf. She had been in labour for two days and a night. I diagnosed a twist of the uterus, and turned her over two and a half times. The calf was coming backwards, and, after the twist was reduced, was delivered without any great trouble. It was, however, dead, but the heifer lived and progressed satisfactorily.

Case C. The patient was a heifer with her first calf. She was noticed to be straining in the field. As she still kept straining, the owner sent for me, and, upon examination, I found that she had a distinct twist of the uterus. I put her down and turned her over twice, but finding that I was turning her in the wrong direction I had her turned back again, and then twice over in the opposite way. "The water bladder" appeared at once, and the calf was passed without any difficulty. She made an excellent recovery.

An Interesting Ovariotomy in the Sow.

In our neighbourhood it is the custom to operate on the sows, not only when they are young, but also when they have finished breeding and require to be fattened.

On two occasions last year I found, on opening the abdomen, that the animal was pregnant. In the first instance the fœtuses were about the size of mice. The owner was standing by at the time, and, with his consent, I removed the ovaries. She carried her pigs the full time and brought forth nine alive and one dead. Of these she reared five or six.

In a second instance, at the same place, I also discovered the presence of fœtuses in the uterus, and, although the owner wished me to serve her the same as the previous case, I refused and merely stitched up the abdominal incision. She aborted all her pigs a short time later.

Original Articles.

ON THE MORPHOLOGY OF THE MAMMALIAN PALATINE RUGÆ.

BY R. G. LINTON
(FROM THE ANATOMY DEPARTMENT, ROYAL VETERINARY COLLEGE, EDINBURGH).

To anatomists and zoologists the mouth, and the structures pertaining thereto, have always been of engrossing interest, and have afforded a profitable field for investigation; but, so far as I am aware, comparatively little work has been done on the rugæ which are present on the hard palate of mammals.

Gegenbaur (1) has dealt fairly thoroughly with the palatine rugæ of man, and has compared them briefly with those of the monkeys; but his comparison has there stopped short.

Harrison Allen (2) has also contributed to the literature on the subject, but he deals mainly with man and touches but in passing on the rugæ of the lower animals.

An attempt has been made in this paper to examine the palates of as many animals as possible and to give a somewhat broad comparison of the individual results obtained. That such a comparison is not without interest is shown by the great variety of rugæ met with, the difference in their number and, what is perhaps of greater interest, the statement made by Gegenbaur that the palatine rugæ of man have apparently lost their function and are of no further use. It would seem from his investigations that the rugæ in man, having lost their function, are being discarded; for, never well developed at the best, they become more faintly marked with increasing age. So far as I am aware this degeneration of the rugæ is not to be seen in any of the lower animals, unless it be in the anthropoid apes.

Huxley (3) points out the great value of the palatine rugæ to the Sirenia, when he says, "The premaxillary region of the palate and the corresponding surface of the mandible are coated with mammillated and rugose horny plates formed by hardened epithelium; and in the extinct genus *Rhytina*, these plates were the only masticating organs, as there were no teeth."

Perhaps the most specialised form of palatal rugæ are those of the Baleen whale—the *Baleenplates*.

As is well known, each half of the mammalian palate is beset with transverse ridges—few in some animals, many in others—which are generally more or less curved conformably with the curve of the series of incisor teeth. The ridges on the two sides of the palate may or may not be symmetrically arranged, and may or may not be separated by a definite median longitudinal raphe.

Each ridge has a more or less sharp summit, with or without dentations, and of its two slopes one is usually the more abrupt. Sometimes a flat valley intervenes between the adjacent ridges; sometimes the opposite slopes of the ridges meet at an angle more or less acute.

In comparing a series of palates variations are found in the number of the ridges; in the character of their summits; in the nature of their slopes; and in the width of the intervals between the ridges. The present communication is of the nature of an endeavour to bring out those variations and to correlate them as far as possible.

It has been found that the distance to which the rugæ extend backwards on the bony palate differs considerably in various animals. To show this variation the more easily a table of indices has been computed, the uniform method adopted being as follows: The length of the hard palate has been measured from the anterior border of the incisor teeth or dental plate and this measurement has been taken as 100. The rugose palate has been measured in a like manner and the index computed thus:—

$$\frac{\text{Length of Rugose palate} \times 100}{\text{Length of hard palate}} = \text{Index.}$$

In the same table, which will be found placed before the general conclusions, the number of rugæ more commonly met with is also stated. Where the measurement is unconfirmed a * is placed against it.

Though the number of animals examined has not been very great, yet the scope has been fairly wide.

MARSUPIALS.

Azara's Opossum (*Didelphys azaræ*).

The palatine rugæ of this opossum are, on the whole, very well developed and bear a strong likeness to those of the carnivora. There are, however, several important modifications, the chief of which is in the form of the folds at the back part of the palate.

The greater number of the rugæ are curved with the convexity anterior, the curvature becoming less towards the back part of the palate. The lateral ends of the rugæ are continued down the gums, ending either on or between the teeth. This is better seen in the anterior part of the palate where the roof of the mouth is flatter. There is a greater amount of inter-rugose palate in this animal than in the carnivora, and the hard palate is continued for some distance behind the last molar tooth, and at its termination is bounded by a transverse ridge, such as is present in a large number of animals, and frequently caused by a prominence at the posterior border of the palatine bone (*e.g.*, Orycteropus and hedgehog).

The degree of slope of the rugæ is not the same throughout the series. The first three have a more abrupt posterior slope, so that the folds are inclined backwards. The fourth is vertical, while the remainder have an abrupt anterior slope, the posterior surface passing gradually on to the palate. This condition is more marked at the back part of the palate.

All the rugæ meet and become completely blended with their fellows at the middle line, and the two sides are symmetrical in their conformity.

The only indication of a median raphe is a slight disjointed groove in the posterior third of the palate.

On the first half of the palate the rugæ are covered with low papillæ, which are firm to the touch and directed backward. The palate between the rugæ, as far back as the fifth fold, is also invested with papillæ of a like structure. On each side of the incisor papilla is a longitudinal fold, whose posterior extremity becomes blended with the first ruga.

EDENTATES.

Orycteropus afer (fig. 1).

The Aard-vark has palatine rugæ which bear no resemblance to those of the other edentate (the Armadillo) I have examined. They are very poorly developed, scarcely rising above the level of a palate, which is almost perfectly flat. This lack of prominence of the rugæ is the more remarkable in that the food of the Orycteropus consists of termites—practically the same as that of the Armadillo (4)—and, when we take into consideration the physiological function of the palatine rugæ in assisting in the retention and mastication of the food, it seems feasible to suppose that better-developed rugæ would be of greater assistance in keeping termites within the mouth. The scanty prominence of the folds seems, however, to be compensated by their greater number and, in most cases, sharp posterior border, together with the flattened nature of the palate and the stickiness of the tongue.

There are thirteen fully developed folds, and between each is a secondary ridge, better marked at the anterior part of the palate, while posteriorly it is only indicated by a row of small, low papillæ. The majority of the folds meet their corresponding entities at the median raphe, which is marked by a low ridge, though at the front of the palate this ridge becomes ill marked, and in places disappears altogether. The lateral ends of the ridges, in all cases, touch the gum. Their curvature is inconstant, and in the middle of the series is quite lost; and here the rugæ stretch from the gum to the median raphe in a straight line, thus forming an angle of about 45°.

Throughout the whole series the summit is directed backwards. At the anterior part of the palate some of the rugæ are separated from their corresponding fellows and thus show a slight asymmetrical arrangement. The rugæ are situated furthest apart at the middle of the series and closest together anteriorly. With the exception of those previously mentioned, the palate is quite devoid of papillæ and the summits of the rugæ are smooth and non-dentate. The posterior part of the hard palate is marked by a prominent ridge (see fig. 1),

of which mention is made by Flower and Lydekker (4) and also by Sclater (5), who remark that it is formed by the palatine bones, the pterygoids not taking any part in the formation of the hard palate. This, though present in a large number of mammals, is seemingly more prominent in insectivorous animals.

It should be remarked that the head of this Aard-vark had undergone a certain amount of drying previous to pickling, therefore there may be some slight inaccuracy in the minor details.

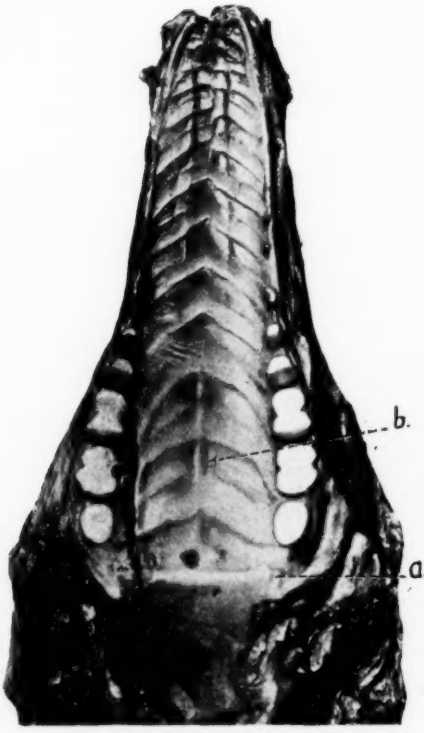

FIG. 1.—Hard palate of the Aard-vark (*Orycteropus afer*). *A.*—The prominent ridge bounding the posterior limit of the hard palate. *B.*—The median raphe.

FIG. 2.—The hard palate of the Armadillo (*Dasypus sexcinctus*).

ARMADILLO (*Dasypus sexcinctus*) (fig. 2).

This armadillo has eight very well-developed rugæ which stretch as far back as the penultimate cheek tooth. The rugæ of the two sides are symmetrical and all meet and blend with those of the opposite side of the palate. Their lateral extremities are placed on a level with and abutting against a tooth (see fig. 2).

There is a conspicuous fold of the mucous membrane at the extreme anterior part of the palate. The first four folds have their

posterior slope more abrupt than the anterior; the fifth is vertical, and the last three are inclined in an anterior direction. The palate is remarkably free from irregularities or rudimentary folds, and the summits of the rugæ are smooth and devoid of papillæ. Between the folds, however, there are numerous low papillæ, placed without any apparent definite formation.

Unlike the other insectivorous animals examined, the additional posterior ridge is absent, there being no line of demarcation between the soft and hard palates, the latter ending on about a level with the last cheek tooth.

The median raphe is indicated by a ridge fairly prominent behind, but becoming indistinct towards the front of the palate. It will be noticed in fig. 2 that the degree of curvature in individual rugæ changes considerably, the fifth and sixth passing in a straight line across the palate.

UNGULATES.

Pig (*Sus scrofa*) (fig. 3).

Great in number and closely packed, the pig's palatine rugæ present striking differences from those of the other ungulates which have been examined.

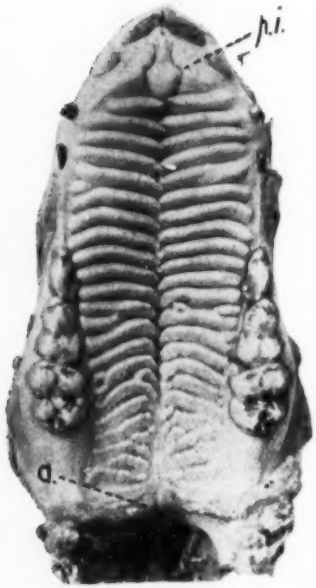

Fig. 3.—The palatine rugæ of the Pig (*Sus scrofa*.) *A.*—The posterior limit of hard palate. *P.I.*—Papilla incisiva showing its transverse constriction.

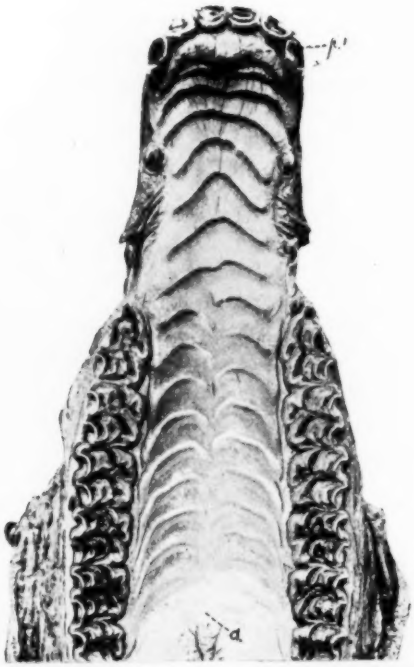

Fig. 4.—The hard palate of the Horse (*Equus caballus*), showing the inclination of the posterior rugæ. *P.I.*—Papilla incisiva. *A.*—The posterior limit of the hard palate.

From the incisor papilla to the fourth cheek tooth they are well formed, regular, and the corresponding folds of each side are for the most part symmetrical. Behind this they become irregular and fail to reach the middle line, the last four or five being coarsely dentated and in many cases may be said to be formed of papules of varying size (see fig. 3).

For the greater part the rugæ of the two sides are placed on alternate levels, and those on the anterior half of the palate slightly cross the middle line. Some few pass in a straight line across the palate, but the majority have a slight curvature with the convexity forwards; this feature varying, to some extent, in individual pigs. Of the well-developed rugæ, no one can be said to be better developed than the remainder, this being opposed to Harrison Allen's (2) hypothesis that the best developed rugæ is that situated on the suture between the premaxillary and maxillary bones.

The anterior slope in nearly all cases is more abrupt than the posterior, this being especially well shown in the hinder rugæ, where the posterior slope is prolonged and gradual.

So closely packed are the rugæ that there is practically no inter-rugose palate. The incisor papilla is well developed and pear-shaped; the transverse constriction—greater in some pigs than in others—is of interest since it is stated by Allen to occur not infrequently in man.

Horse (*Equus caballus*) (figs. 4 and 5).

Herbivorous animals, as a rule, have their palates thrown into folds which differ considerably from those of other classes such as the Carnivora or Insectivora. In this respect there is a close similarity between the horse, ox, sheep, hare and rabbit, which is not restricted to the form, but is also noticeable in the number of the rugæ, for in those herbivorous animals that I have examined the number most constantly found is 16—17 (see fig. 4). Prof. McFadyean (6), however, states that the number in the horse is from 18—20. Ellenberger and Baum (7) place the number at from 16—18, and Martin (8) says the same. The rugæ occupy practically the whole of the hard palate which ends on about a level with the anterior border of the last cheek tooth, and is bounded by a slight elevation of the mucous membrane.

According to Martin those rugæ lying anterior to the first cheek tooth are best developed and wider apart, and Ellenberger and Baum concur.

The better developed rugæ are usually the first seven to nine; and they are, moreover, blended with their fellows of the opposite side, except in cases where there has been an unequal growth of the two sides (see fig. 5).

Posterior to the ninth the rugæ of opposite sides have their median extremities separated, and in some instances end abruptly; the others taper considerably.

Martin remarks that the hindermost rugæ are somewhat confused. This, however, seems to be limited to their lateral extremities which, in some subjects, are continued for a long distance backwards on

the gums, where they are often placed close together, and not infrequently touch each other. Moreover, their summits are here projected forwards.

Of the character of the slopes of the rugæ as a whole, Martin states that the posterior is the more abrupt. This is undoubtedly the case; but there is a tendency in some animals for the posterior folds to have their anterior slope more sharply indicated than the

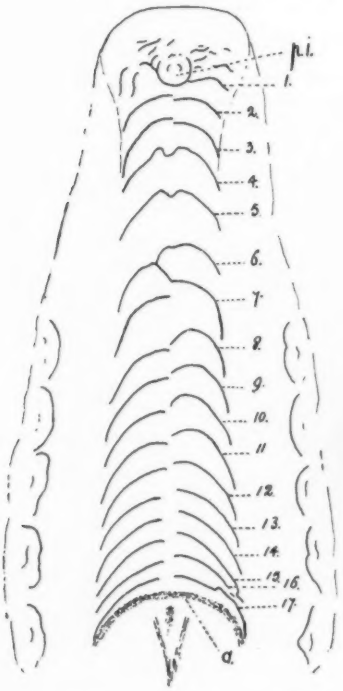

FIG. 5.—Diagram of a foal's palate showing an irregular growth of the rugæ. *P.I.*—Papilla incisiva. *A.*—Ridge marking the posterior limit of the hard palate.

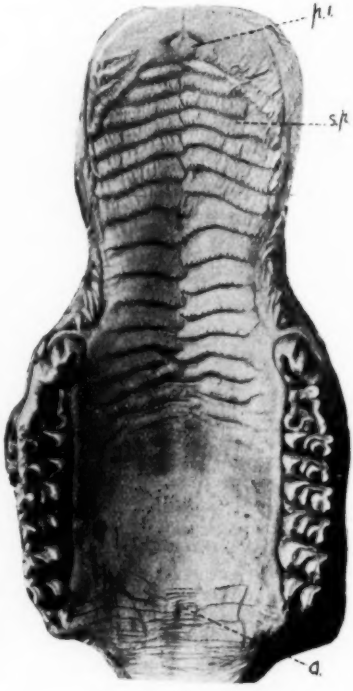

FIG. 6.—The palatine rugæ of the Ox (*Bos taurus*). *S.P.*—Secondary row of papillæ on the surface of a rugæ. *P.I.*—Papilla incisiva. *A.*—The posterior limit of the hard palate.

posterior. A great deal of individual variation exists in this respect. In some animals there is no doubt whatever that the rugæ situated at the back of the palate are inclined backwards. In other specimens it is difficult to determine whether the anterior or the posterior slope is the more abrupt.

The palate of the horse, on the whole, may be said to be moderately free from irregular rugæ. It is quite devoid of papillæ, and none of the folds show the least indication of being dentated.

The median raphe is often indistinct, and frequently cannot be detected posteriorly.

The Donkey (*Equus asinus*).

There is no great difference between the folding of the palate of the donkey and that of the horse. The slope of the posterior rugæ towards the front of the palate is here brought out very clearly, and is especially well shown in the last three or four folds; more so at the lateral extremities than towards the middle line.

The number is seventeen, and in all other respects the rugæ are identical with those of the horse.

The Ox (*Bos taurus*) (fig. 6).

The palatine rugæ of the ox differ very considerably from those of the horse. They do not possess that form which is found in the horse and usually described as "bow-shaped," but extend in more or less of a straight line across the palate. In some cases they meet and become blended with their fellows at the middle line, but this conformation is by no means regular, as the ridges are often placed on alternate levels with their median extremities slightly overlapping the middle line.

The rugæ occupy that part of the palate which lies between the dental plate and the third cheek tooth.

As far back as the anterior border of the first cheek tooth the rugæ are well developed and richly dentated, at and behind which the rugæ lose their dentate character, gradually becoming perfectly smooth and less developed until they are insensibly lost. The rugæ which have their summits situated farthest apart are those placed at the narrow part of the palate. On the surface of the anterior folds there is an indication of a secondary row of papillæ (fig. 6, S.P.), and between the first two or three rugæ there is sometimes an additional row of backwardly directed low papillæ.

Martin (8) states that the first twelve to thirteen rugæ are the best developed and dentated, and that the last three or four are broad, flat and less developed. He also remarks that between the rugæ are often to be found small non-dentated intercalated folds. It is by no means uncommon to find small rugæ between the well-developed ones, but they do not seem to be lacking in dentation.

The ridge, present in the horse at the posterior limit of the hard palate, is absent in the ox.

In the adult there is practically no indication of a median raphe at the posterior part of the palate, but anteriorly its position is shown by a groove. The alteration of this raphe and some other points observable in the development of the rugæ during intra uterine life are of some interest.

In calf embryo No. 1 (138 mm.) there are seventeen distinct rugæ, and between them are a number of irregular faint markings. None of the rugæ bear any indication of being dentated, their free borders being very distinct and quite smooth. They are better developed at the front of the palate, becoming fainter behind, and especially so at the sides.

The row of papillæ present in the adult on the surface of the anterior rugæ is also present in this embryo.

Unlike the condition found in the adult the median raphe is in the

form of a well-marked and prominent ridge, which stretches from the incisor papilla on to the soft palate.

Embryo No. 2 (175 mm.).—At this stage the rugæ are in much the same state of development as in the younger embryo. They are still destitute of dentation and their free borders are smooth as before. The median raphe shows signs of alteration. On the soft palate and as far forward as the hindermost rugæ it has given place to a groove; whereas in front of this, for a short distance, the ridge is beginning to be broken; but, as in the younger specimen, a ridge is still present on the greater part of the rugate palate.

Embryo No. 3 (322 mm.).—The rugæ are beginning to assume the adult dentated character, and more so at the anterior part of the palate.

Posteriorly the median ridge has entirely given place to a groove, but where the palate becomes narrow there are still indications of a ridge. At the extreme anterior part of the palate—as far as the fourth or fifth ruga—the ridge is quite prominent, though showing signs of becoming broken up.

Embryo No. 4 (fifteen days before the full period of gestation).—This palate is practically the same as that of the adult; the same number of rugæ are dentated, and as richly so as in the full-grown animal.

The median ridge has entirely disappeared, the raphe being indicated by a groove, which is well marked and extends right back on to the soft palate. Indeed it is better marked than in the adult.

From the foregoing observations we may arrive at the following conclusions:—

(1) That dentation is completely absent in the young embryo, even though the folds may be well developed.

(2) That dentation occurs late in the life of the fœtus.

(3) The median raphe, which in the adult is not distinguishable posteriorly and is marked by a groove anteriorly, primarily starts as a prominent ridge extending the whole length of the hard palate and even on to the soft palate.

(4) This ridge, as the embryo increases in size, becomes lost and gives place to a groove; the process starting behind and proceeding forwards.

(5) The groove thus formed becomes lost in a like manner—from behind forwards.

The Sheep (*Ovis aries*) (fig. 7).

Although the sheep's palatine rugæ resemble the ox's in their general form and number, they differ very strikingly in being absolutely devoid of dentation. At the posterior border of the dental plate there are, however, frequently deep and coarse dentations, but unlike the ox's, they are rounded instead of being narrow and pointed.

As in the ox, the best developed rugæ lie between the dental plate and the first cheek tooth, behind which they become fainter, somewhat irregular and not infrequently continuous with their fellows of the opposite side (see fig. 7, F).

The rugæ are more regular in their formation and stretch in a straighter line across the palate than in the larger ruminant. Often the rugæ of the two sides are placed at different levels, with their median extremities slightly overlapping the middle line; but frequently they are placed on the same level and meet their corresponding entities at the median raphe.

It is perhaps worthy of note that in ruminants the non-rugate palate corresponds to the raised and papillated rurface of the tongue—a circumstance also noticeable in the rabbit and hare.

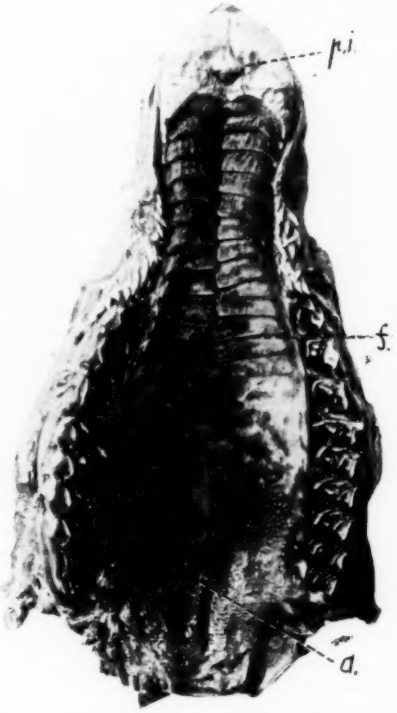

FIG. 7.—The hard palate of the Sheep (*Ovis aries*). *F.*—Showing the fusion of corresponding rugæ.

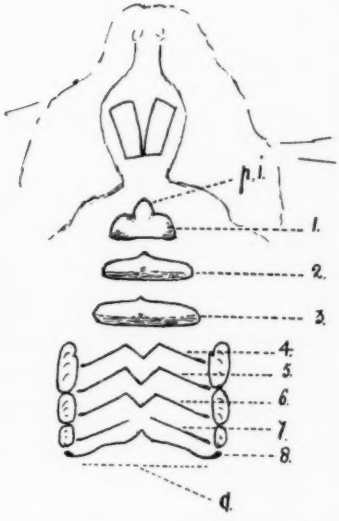

FIG. 8.—Diagram of the rugæ of the Rat (*Mus decumanus*), showing the peculiar shape of the posterior rugæ, and the large size of numbers 1-3. *P.I.*—Papilla incisiva. *A.*—Marks the posterior limit of the hard palate.

In the adult sheep the median raphe, from the dental plate to the first cheek tooth (sometimes as far back as the second or third cheek tooth), is indicated by a well-marked groove. For a short distance behind this there is no raphe distinguishable, and then a ridge, caused by the meeting of the palatine and to a certain extent of the superior maxillary bones at the middle line, appears and is continued on to the soft palate.

A fair number of embryos, ranging from 73 mm. up to the full period of gestation, have been examined macroscopically. At 73 mm. the full number of rugæ is present. The hindermost are faint and none bear any indications of dentation.

Perhaps the only point at all noteworthy is the variation in the form of the median raphe. In a 73 mm. sheep embryo a ridge extends the whole length of the palate. It is more prominent in front, and behind it is placed within a groove.

There is not much difference to be noted in a 108 mm. embryo, except that the posterior groove is possibly deeper, and the ridge within it less prominent.

In a 152 mm. embryo the groove has become less deep and more wide; the ridge still persisting throughout the whole length of the palate. In an embryo of 183 mm. the ridge has practically disappeared, though still present in places in the anterior portions of the palate.

In a full-time fœtus the antero-posterior ridge has quite disappeared and a well-marked groove extends the whole length of the palate. There is a point to be noticed here of some considerable interest, viz., that the rugæ bear distinct traces of being dentated, though the areas are limited and the dentation is not deep and scarcely discernible without the aid of a lens.

From this macroscopic examination the following points of moment emerge:—

(1) That the rugæ are well developed at an early life of the embryo of the sheep.

(2) That there is no indication of dentation until the full time of gestation has been reached; and even then it is, at the best, very indistinct.

(3) That such dentation as there is disappears as the animal grows older.

(4) The median raphe follows practically the same lines of development as that of the ox.

The Spring Buck (*Antidorcas euckore*).

The animal from which these observations were taken was very young, apparently having died at birth or possibly not quite at the full period of gestation.

The palatine rugæ are very similar to those of the ox and sheep. They number seventeen, of which only two are rudimentary.

The rugæ resemble the sheep's, in that they stretch in an almost straight line across the palate, and they have a close resemblance to those of the ox in being finely dentated, and also in having a row of papillæ on their surfaces.

The palate is remarkably free from irregular and rudimentary rugæ, and the last two or three folds have their lateral extremities continued some distance backwards in a curved direction along the line of the gums. There is a greater amount of inter-rugose palate at the anterior part of the mouth than occurs in either the ox or the sheep.

The anterior part of the median raphe is indicated by a broken ridge, and posteriorly by a faint ridge placed in a groove.

The Camel (*Camelus bactrianus*).

The only specimen which has been examined was an aborted eleven months' fœtus. The rugæ are very small, faint and badly developed. At the most their number may be stated as twelve. They bear no resemblance whatever to the rugæ found in the other herbivorous animals examined, their presence being only shown by a slight elevation of the mucous membrane. They start about half-way between the gum and the median raphe, which, in most cases, they touch.

The median raphe is marked by a ridge, which, in some places, is nearly as prominent as the rugæ, but gradually fades away as it is traced backwards. At the back of the palate a ridge is again present, but here it is evidently caused by the prominence of the suture between the two superior maxillary and the two palatine bones.

Whether the rugæ increase in size as the animal grows older I am unable to say; but, considering that the palatine rugæ are developed so early it does not seem likely that they would alter to any appreciable extent. At this stage the camel certainly has the nearest approach to a smooth palate of any animal that I have examined, with the exception of a Hystricomorph, which will be mentioned later.

RODENTIA.

For purposes of description of their palatine rugæ, it will be found convenient to take the rodents in their four great sections, viz.: (1) the Sciuromorphs; (2) the Myomorphs; (3) the Hystricomorphs; (4) the Lagomorphs.

The Lagomorphs differ entirely from the rest in the arrangement of their rugæ; but among the members of the remaining three sections there is a certain, though perhaps slight, similarity. Unhappily it has only been possible to procure one species of a Hystricomorph and one Sciuromorph, therefore what might have been an interesting comparison could not be made.

SCIUROMORPHS.

The Squirrel (*Sciurus vulgaris*).

The common English squirrel has ten palatine rugæ, all of which, with the exception of the first, have an abrupt anterior slope, so that the folds are inclined in a forward direction.

The first four rugæ are much better developed and more prominent than the remainder. They are located between the incisor papilla and the first cheek tooth, which fact is of some interest when a comparison is made between the squirrel and all other rodents, with the exception of the Lagomorphs.

These four well-developed anterior rugæ are all blended with their fellows at the middle line, thus producing a common curve whose convexity is anterior, the degree of curvature diminishing from the first to the fourth.

The fifth and sixth rugæ are slightly less developed than the first four, from which they further differ in having their median extremities

continued backwards along the raphe, this being specially pronounced in the sixth. They also blend with their opposite fellows, but not so completely as do those in front of them.

The remaining four ridges are not nearly as well developed nor so prominent. They are placed close together and their median ends are separated by an increasing interval. The most posterior ruga is very rudimentary and its lateral end fails to reach the gum.

The margins of the rugæ are smooth and devoid of either dentation or papillæ; but the inter-rugose palate is studded with low papillæ, which, in some instances—notably between the fifth and sixth, and sixth and seventh folds—are arranged in definite rows, thus producing the appearance of an attempt at the formation of additional rugæ.

The incisor papilla, relatively large and prominent, is blended with the first ruga though not so completely as in the Myomorphs.

The median raphe is indicated by a low ridge at the front of the palate, but becomes lost behind, being quite absent where the rugæ fail to meet the middle line.

MYOMORPHS.

The few myomorphs which have been examined show an unusual and interesting arrangement of palatine rugæ, which cannot be likened to any other folds which have been observed except, possibly, those of the squirrel. For purposes of comparison of the Myomorphs, the brown rat has been taken as the type.

Brown Rat (*Mus decumanus*) (fig. 8).

On that part of the hard palate located between the incisor and cheek teeth there are three rugæ which, relatively, greatly exceed in size any folds that I have noticed in animals outside the Myomorphs. The first fold has a considerable antero-posterior breadth and the incisor papilla is blended with its anterior surface. This fusion of the first ruga of opposite sides and the incisor papilla gives to the whole an outline not unlike that of a club of playing cards with the base cut off short (see fig. 8).

At some short distance behind the first ruga is the second, which is developed to a very high degree. It has a greater lateral breadth than the first, is completely blended with its fellow, and at the point of union there is a slight tendency to a forward projection.

The third fold, placed just in front of the cheek teeth, is similar to the second, but has a greater lateral breadth.

Both the second and third ridges slope forwards, this being better marked in the third.

At that part of the palate between the cheek teeth are rugæ of an entirely different character. As the others were conspicuous by their great size and simplicity of character, these are notable on account of their complex form and small development.

These peculiar rugæ constantly number five; and the first three have a form that I have not noticed in any other animal. Starting from the gum, in a slightly bulbous manner, they extend forwards and towards the middle line at an angle of about 45°. Some distance

from the raphe they turn backwards and inwards and meet their fellows from the other side; the two retrograde portions thus meeting on the median raphe, to form a V with the apex directed backwards.

The penultimate fold is devoid of this peculiarity; merely extending toward the middle line in the same manner as those in front of it, but failing to turn backward.

The most posterior fold is also peculiar in form. The rugæ of each side meet at the middle line and the two combined have the form of a printer's brace, with the ends turned up and enlarged (see fig. 8). The thickening of the lateral ends, which is peculiar to all the posterior rugæ, is more pronounced in the last.

Sometimes, between the two last folds there is an attempt at the formation of an additional ridge, but it apparently does not extend beyond the bulbous portion. With the exception of this intercalated piece, the palate is free from irregularities and rudiments; nor is there any indication of papillæ or of dentation of the rugæ.

In describing the mouth of the rodents generally, Flower and Lydekker (4) state that the peculiar ingrowth of the hairy integument of the face into the anterior part of the mouth may be for the purpose of keeping any substances, not intended for food, from getting swallowed during the burrowing process of the animal. It seems feasible to suppose that the excessive growth of the palatine folds—found only in some rodents—may be intended for a like purpose.

In the Hystricomorph that I have examined there is an almost total lack of rugæ, but there is a growth of hair across the whole breadth of the anterior part of the palate. Moreover, that part of the palate between the cheek teeth is raised considerably above the level of the anterior part. It does not seem inconsistent to suppose that these two factors could quite well serve the purpose of keeping foreign substances out of the gullet, and that, consequently, there would be no need of such prominent rugæ in the Hystricomorph as are found in the rat or the vole.

The Mouse (*Mus musculus*) (fig. 9).

Considering the close relationship of the rat and mouse, together with the fact that they are both omnivorous, it is to be expected that their palatal rugæ will differ but little, and this is found to be the case.

What variation there is is confined to the posterior rugæ, the three most anterior being precisely the same as those of the rat.

The posterior rugæ, moreover, may be dismissed in a few words. As will be seen in fig. 9, the main difference lies in the lack of recurvature which is so characteristic of the rat. They are curved with the convexity forward, and their median ends are continued slightly backwards. The hindermost ruga is much the same as that of the rat. Not infrequently the last three or four rugæ are interrupted, or formed of papules.

There is a certain amount of individual variation (I have examined over a score of specimens), but it is chiefly confined to the degree of development of the hinder rugæ. As in the rat, the rugæ occupy practically the whole of the hard palate.

THE WATER VOLE (*Microtus amphibius*).

There are a few points in which the rugæ of the water vole differ from those of the common rat. The three anterior rugæ have a very close resemblance to those of the rat, but the incisor papilla is very much smaller and inconspicuous.

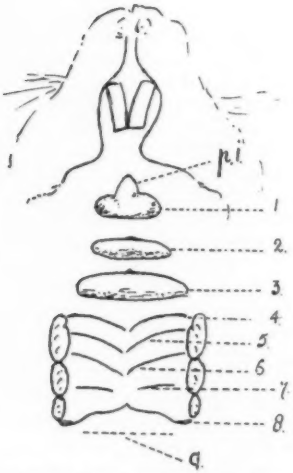

FIG. 9.—The rugæ of the Mouse (*Mus musculus*), showing the different arrangement of the posterior ridges from those of the rat. Lettering as in fig. 8.

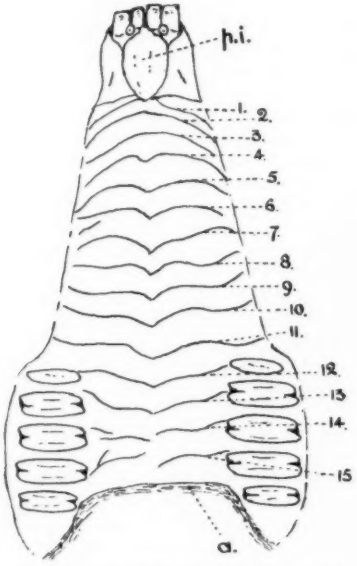

FIG. 10.—Diagram of a rabbit's palate. *P.I.*—Papilla incisiva. *A.*—Ridge marking the posterior limit of the hard palate.

In addition to those well-developed folds there is another of much the same size, present on both sides of the palate, and situated on that raised part of the palate which lies in front of the cheek teeth. It differs from those in front of it in failing to meet its fellow; in being curved, and in having its median extremity continued further back than its lateral end. Posterior to this there are five rudimentary folds, very poorly developed and apparently of not much consequence. The last extends right across the palate, is dentated on its summit like the rest, and is inclined forwards.

The posterior limit of the hard palate is not marked by a ridge, but is continued without any line of demarcation on to the soft palate. In this respect the *M. amphibius* differs from both the rat and the mouse.

The field vole (*M. agrestis*) is so similar to *M. amphibius* that a separate description is not necessary.

HYSTRICOMORPH.

The Coypu Rat (*Myopotamus coypu*).

The Coypu is peculiar in having its palate practically devoid of rugæ, it being only possible, by a careful examination, to find traces of rugæ which apparently correspond in number and position to those of the Myomorph.

That part of the palate between the cheek teeth is raised considerably above the level of the anterior part. The growth of hair across the palate, just behind the incisor teeth, has been previously remarked upon; at its posterior limit there is a very large and somewhat pendulous incisor papilla which slopes in a backward direction. Both a young and an old specimen have been examined and the same peculiarities found in each.

LAGOMORPHS.

The Rabbit (*Lepus cuniculus*) (fig. 10).

The rabbit's palate is very rich in folds. They number from fifteen to seventeen, are well developed, placed close together and occupy the whole of the hard palate, which terminates, at about the level of the fourth cheek tooth, in a transverse ridge extending uninterruptedly across the palate (fig. 10).

The rugæ bear some resemblance to those of the sheep. They are quite free from papillæ, and their edges are smooth. At the anterior part of the palate the free border of one ridge overlaps the base of the succeeding ruga. The rugæ are broadest and situated farthest apart at about the junction of the anterior and middle thirds of the series.

All the folds meet at a median raphe indicated by a groove, and, with the exception of some of the more posterior, blend with their fellows of the opposite side. The first three or four have their median extremities directed forwards, and their lateral ends curved backwards (see fig. 10); but behind the fourth the curvature is reversed—a peculiarity better marked in some specimens than in others. All rugæ are directed backwards, except the last two or three, which are vertical.

Situated on either side of the large papilla incisiva is a peculiar shaped, somewhat elongated fold.

A macroscopic embryological examination reveals no points of moment, except that the rugæ apparently develop at an early stage of intrauterine life, and are never dentated.

The Hare (*Lepus timidus*) (fig. 11).

The difference between the palatine rugæ of the hare and rabbit is very slight; and such slight differences as exist may be due to some extent to individual variation, since the number of hares examined has been unfortunately limited.

As stated by Flower and Lydekker (4), the hard palate is shorter in the hare than in the rabbit. As will be shown later in the table

of measurements taken from adult animals, there is a deficit of 4 mm., and there is apparently a correlated loss of one ruga. Whether this is a specific difference cannot be determined without the examination of more abundant material.

In the specimen from which the diagram was made is shown very clearly an alteration in direction of the joined median extremities of opposite rugæ. In Nos. 4 and 5 the projection is forwards; in No. 6 it is backwards (see fig. 11). The remainder also have their central ends directed posteriorly; but they are broken and irregular.

The last four ridges converge towards the middle line, where they taper considerably.

Without exception all the rugæ are inclined backwards.

HYRACOIDEA.

Procavia capensis (fig. 12).

In the Hyrax the folding of the palate is brought to a very high pitch. Practically the whole of the hard palate is rugate, and the folds are very thick, prominent and close together.

Immediately behind the incisor teeth, and in contact with them, is a peculiar prominence which, upon close examination, seems to be formed by an elevation and crowding of folds in upon the incisor papilla (fig. 12).

In the two specimens examined this prominence is identical in

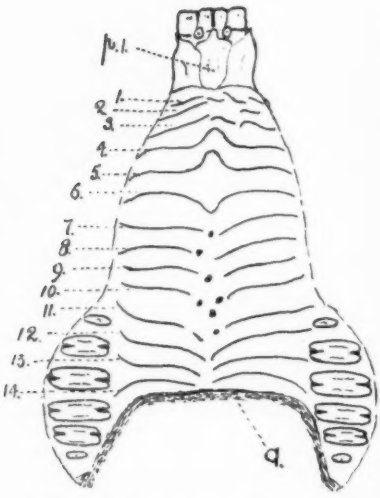

FIG. 11.—Diagram of a hare's palate. Compare the direction of the rugæ with those of the rabbit (fig. 10). *P.I.*—Papilla incisiva. *A.*—The posterior limit of the hard palate.

FIG. 12.—Hard palate of the Hyrax (*Procavia capensis.*)

shape and structure. In the middle line and arranged with its long axis agreeing with the long axis of the palate, is a single fold, evidently the incisor papilla. On each side of it are three folds, placed one against the other, with their median extremities converging to, and meeting at, the middle line, where they are directed in a backward direction. This conjugation of ridges is situated at a considerably higher level than the remainder of the folds.

Between it and the posterior limit of the hard palate are eleven rugæ on each side; the great majority of which are very well developed and free from irregularity. In one specimen, however, there were a number of irregularities at the posterior part of the palate.

The first five rugæ slope backwards, the sixth is vertical, and the remainder look decidedly forward, the slope increasing as the rugæ recede. None of the folds blend at the middle line, and the rugæ from one side alternate in position with their fellows from the other side, their median extremities crossing over and passing in between those of the opposed rugæ.

None of the rugæ are dentated or papillated, nor are there papillæ between the folds. Consequent upon the close packing of the rugæ, a very small amount of plain palate is visible between them.

The hard palate does not extend beyond the posterior limit of the dental series, and, at its termination, is marked by a low and not very distinct ridge.

CARNIVORA.

Of Carnivora I have examined the lion, cat, dog, stoat, weasel and mongoose.

The Lion (*Felis leo*) (fig. 13).

In the lion and the cat there is, as would be expected, a great similarity, both in the number and in the form of the rugæ. The lion has eight well-marked ridges; a rudimentary one anterior to the papilla incisiva, and numerous irregular rudiments at the posterior part of the hard palate. These last will be described later.

The rugæ, on the whole, may be said to be fairly prominent and irregularly bow-shaped. They are all dentated, but more especially the posterior ones, which might even be described as serrate. The two most anterior have not this dentation so well marked; furthermore, the dentation becomes lost at the thickened and prominent lateral extremities of all the rugæ, which are in the form of folds hanging backwards, a condition best marked in Nos. 6 and 7.

Without exception all the rugæ meet and apparently become blended with their fellows from the opposite side at the median raphe, where the symmetry of the curve is broken and there is a tendency for the rugæ to be, as it were, prolonged backwards, more especially at the posterior part of the palate.

In all cases the anterior slope is more prolonged than the posterior, so that the rugæ are inclined in a backward direction. On both the anterior and posterior surfaces there are numerous prominent papillæ directed backwards and usually arranged in uniform lines, but sometimes without any regular disposition.

These papillæ attain their greatest size and are most numerous between the sixth and seventh rugæ.

Of the individual rugæ the first is the least well marked and is interrupted by the incisor papilla. The second is peculiar in that, at some distance from the median line, it becomes bifid, and at the middle line, the two extremities so produced become slightly tucked in to meet the corresponding structures of the opposite side. Whether this is an individual peculiarity, or is constant in the larger Felidæ, I am unable to say.

Of the other rugæ, Nos. 6 and 7 are the best marked, their lateral extremities being continued a long way back on the gums, where, as before stated, they form thick prominent folds. No. 8 is not so well developed, but a greater part of it is dentated. Its curvature is great and its lateral end does not reach the gum but terminates at some distance anterior to that of the seventh ruga.

Situated in the concavity formed by this fold are some attempts at the formation of more rugæ, as well as a few independent papillæ. These rudiments have no conformity in arrangement or shape, and are serrated throughout their entire length. Like the more regular folds they are directed backwards.

The median raphe is in the form of a low ridge and best marked at the anterior part of the palate.

The Cat (*Felis domestica*) (fig. 14).

As before remarked the palatine rugæ of the cat resemble those of the lion very closely. There is, however, an additional fold, and an almost total absence of those rudimentary ridges present on the posterior part of the hard palate in the lion. The only indication of rudimentary posterior folds is in the form of inconstant aggregated papillæ which, when present, give the appearance of an attempt at the formation of additional rugæ.

A fold, unrepresented in the lion, which I have found in the cat in all cases but one, is apparently intercalated between rugæ corresponding to the fourth and fifth of the lion (fig. 14). In the specimen in which the intercalated fold was absent, there was an attempt at the formation of a fold on the left side of the palate between Nos. 3 and 4; and in this specimen, also, the hindermost ruga had a greater development and was situated farther than usual from the one preceding it.

On the whole, the rugæ of the cat are more symmetrical than those of the lion; the curvature of the more posterior is not so great and they are more wavy. The dentation is also carried nearer to the lateral ends than it is in the lion. Not infrequently the last two or three folds are broken at their median extremities.

The papillæ on the rugæ are more regularly arranged than in the lion. At the anterior part of the palate they form a single row on each slope of the ridge, being better marked in the centre and becoming lost towards the side of the palate. At the back part of the palate this arrangement gives place to a larger number of papillæ irregularly grouped, though sometimes placed in two rows. Occasionally there are a few additional and well-marked papillæ at the front of the palate.

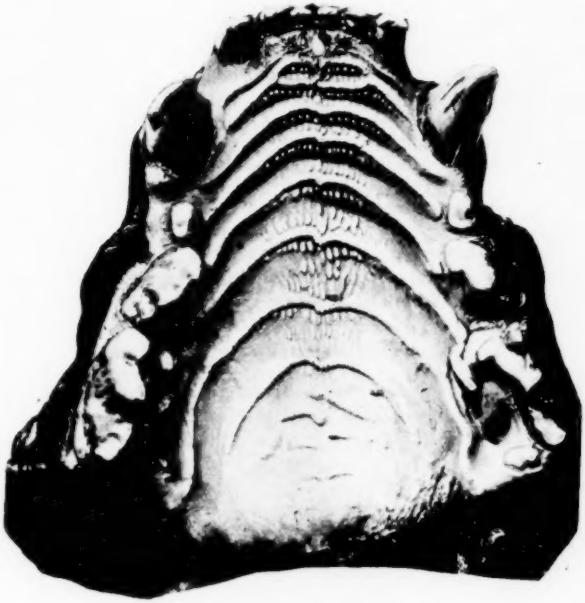

FIG. 3.—The hard palate of the Lion (*Felis leo*).

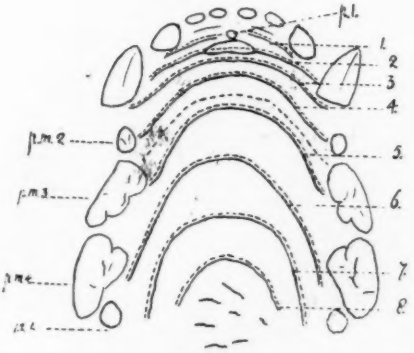

FIG. 14.—Showing the intercalated rugæ in the cat s palate compared with that of a lion. The cat's rugæ are indicated by dotted lines; the lion's by coatinuous lines. *P.I.*—Papilla incisiva. *P.M.*—Premolar. *M.*—Molar.

Botezat (9), in dealing with the distribution of sensory nerves in the cat's palate, says:—"The summit of each ruga has a row of large papillæ" (which he calls 'Haupthöcker') "and on each side of the summit are two rows of smaller papillæ ('Nebenhöcker') arranged parallel to the summit."

Certainly the number of cat's palates that I have examined has not been very great, but in no one instance have I been able to confirm Botezat's statement. In fact, it has always been found that the larger papillæ are those situated on the surfaces of the rugæ and that those on the summit were the smaller. Moreover, it is only on the posterior half of the palate that I have found papillæ in two rows on each slope of the rugæ; and even here this arrangement is not very regular.

There is a certain amount of variation to be found in individual cats, but it is mainly confined to the development of the posterior rugæ and the distribution of the papillæ.

The Dog (*Canis familiaris*) (figs. 15 and 16).

The hard palate of the dog is invested with remarkably prominent and well-developed rugæ, the number of which is mostly nine. The

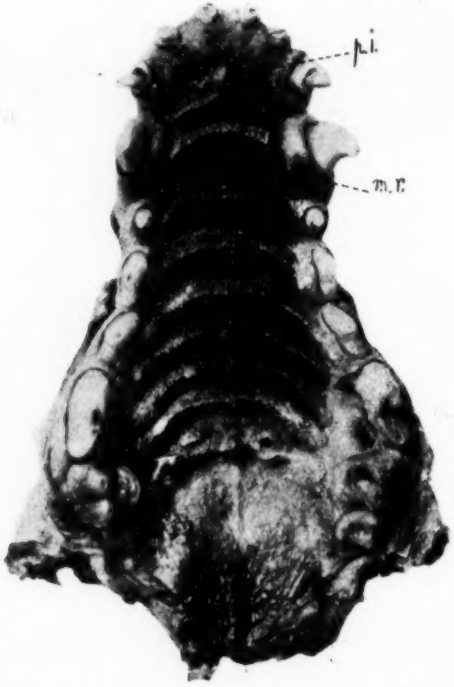

Fig. 15.—The hard palate of a full-grown dog. *P.I.*—Papilla incisiva. *M.R.*—Median raphe.

first eight are regular and have much the same form in individual dogs. The ninth, however, varies very considerably in different specimens; no two dogs having this ruga formed exactly alike. Sometimes it is remarkably complex, and symmetrically so. At other times it is quite simple and again it is not infrequently irregular and unsymmetrical.

The rugæ, as a whole, are curved in form, with the convexity anteriorly, and all meet and blend with their fellows at the middle line.

The tendency that there is in the cat and lion for the rugæ to be flattened at the middle line is better marked in the dog; but this varies considerably in different subjects. None of the rugæ have their summits dentated, but between the folds, and on their anterior and posterior surfaces, there are numerous low papillæ.

In all cases the posterior slope is more abrupt than the anterior, so that the rugæ have a backward direction.

The second and third rugæ are situated farthest apart, the interval appearing to vary in direct relation to the distance between the canine and first premolar tooth. The rugæ are placed closer together towards the posterior part of the palate where, in some instances, their surfaces come into contact towards the gums. There is a less amount of inter-rugose palate in the dog than in the cat on account of the greater width of the rugæ.

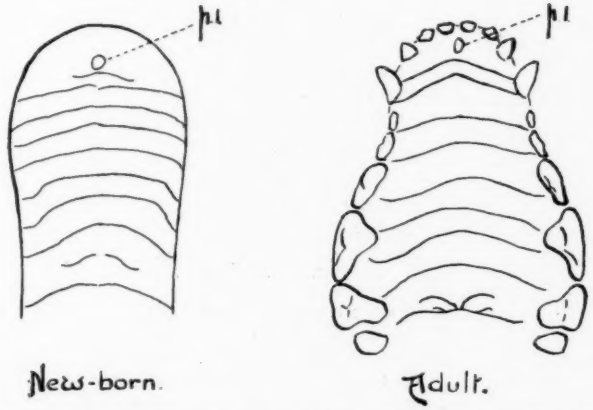

Fig. 16.—Diagram to show the alteration in shape of the palate in the dog. *P.I.*—Papilla incisiva.

In newborn dogs the hard palate is shaped quite different from that of the adult. Its broadest part is at about the junction of the anterior and middle thirds; while in the adult the broadest point is in the posterior third (see fig. 16).

In various litters of puppies examined the rugæ were found to be almost smooth; there being only a faint dentation observable in the first two or three. Nor is there any indication of papillæ either on or between the rugæ. Among the members of a litter of

five fox terrier mongrels there was observed a very striking variation in the form of the last rugæ. So, it may be stated, that even puppies from the same litter have not the same characters of the last rugæ.

In the adult dog the median raphe is shown by a somewhat inconstant and ill-defined ridge; and in the newborn by a slight groove on the posterior part of the palate, changing to a low ridge anteriorly.

In dogs which have their palates artificially shortened there is no diminution in the number of rugæ. In one such specimen (a pug) the rugæ were found to be very closely placed. In fact, the majority of the rugæ were in close contact and huddled together. An effect of this close packing was to give them a forward direction; the reverse of that found in the normal dog's palate. In the pug the second and third folds were not well developed and were unsymmetrical, the best developed being the fourth and fifth. It will be seen in the table of indices that, in the pug, a greater amount of the hard palate is invested with rugæ than in the normal dog.

The Stoat (*Mustela erminea*).

The general slope of the stoat's palatine rugæ is very like that of the cat; but they are without papillæ and have smooth edges. The number is the same in the stoat, the cat and the dog. The first is very indistinct and the eighth is also rudimentary, being only present close to the middle line. The ninth is better developed in the stoat than the corresponding one in the cat, and has a greater curvature.

Numbers two to five and eight meet those of the opposite side at the middle line; but the rest fail to do so. The anterior five are placed closer together than the rest, a feature also noticeable in the cat and lion, but not in the dog. The rugæ are relatively of the same thickness as those of the cat and there is about the same amount of inter-rugose palate visible.

The median raphe (better marked than in the cat) is indicated by a ridge as far back as the fifth fold and behind this by a groove.

The second ruga of the cat is not represented in the stoat, the eighth apparently being added to supply the deficiency.

Weasel (*M. vulgaris*).

There is no striking difference between the rugæ of this Mustela and those of the preceding. There is, however, some individual variation in various specimens mainly restricted to the posterior part of the palate. In both the Mustelæ the posterior slope of the rugæ is more abrupt than the anterior; a condition constant throughout the series.

Mongoose (*Herpestes mungo*).

The mongoose possesses nine rugæ, placed in the same positions, relative to the teeth, as those of the dog. The anterior seven and a small portion of the eighth have their summits dentated and their surfaces papillated as in the cat; but the remainder are devoid of either dentation or papillæ.

Numbers two to five meet and blend with their opposite fellows, but the rest fail to reach the middle line. The three most posterior

rugæ have their tapering median extremities continued some distance backwards. The rugæ are all situated at about the same distance apart, with the exception of the last two, which are somewhat closer together. The last two also have a slight forward inclination; the rest agreeing with those of the dog and cat in this respect. Between the last three or four folds there are interposed a few rudiments.

There is a relatively larger amount of inter-rugose palate than in the cat and fewer papillæ are present.

The hard palate is continued some distance behind the last molar tooth where it narrows considerably.

Only one specimen has been available for examination, so that many of the peculiarities noted may not be characteristic of the species, but due to individual variation.

INSECTIVORA.

The Hedgehog (*Erinaceus europæus*), fig. 17.

The hedgehog has exceedingly well-developed palatine rugæ, which extend the whole breadth of the palate, their lateral ends touching the teeth. Their number is nine and apparently constant. They are all more or less bow-shaped with the convexity of the curve anterior. The first five have the appearance of a single bow, their median extremities being more anterior than the lateral, and they are completely joined at the middle line. The sixth ruga of each side, however, forms a complete and independent bow, which, though meeting its fellow at the median raphe, does not join it. This ruga is vertical, but those anterior to it have their summits directed backwards. The last two are usually less well developed; often irregular and markedly dentated, and the last of all runs completely across the palate on a level with the last cheek tooth.

Situated close behind the last ruga is a prominent ridge extending the whole breadth of the hard palate, and marking its posterior boundary.

With the exceptions already mentioned, the folds are entirely devoid of dentation, and the palate is free from papillæ. The ridges are placed at some distance apart, thus exposing a considerable amount of inter-rugose palate. On the whole they bear a close resemblance to those of the armadillo. The median raphe is indicated by an antero-posterior and not very prominent ridge.

It should be remarked that the hedgehog's tongue bears distinct imprints of the palatine rugæ; better marked in the anterior third, and becoming less distinct behind. It appeared at first sight, that this peculiarity might be caused after death in the process of preservation, but on living animals being procured their tongues were found to be distinctly furrowed transversely, and when fixed in formol the grooves remained.

The Mole (*Talpa europæa*), and Shrew (*Sorex vulgaris*).

The formation of the palatine rugæ of the mole and of the common shrew follow practically the same lines as those of the hedgehog. In

the mole the number is eight, and in the shrew it is ten. Those of the shrew are more regular, none of them are rudimentary, and the last is as well developed as the first. Although there are irregular folds at the back of the palate in the mole, none of them bear any indication of being dentated or papillated.

Agreeing with those of the hedgehog, the anterior rugæ are directed posteriorly, and the posterior members of the series look forward.

The ridge, so prominent in the hedgehog as marking the posterior boundary of the hard palate, is also to be seen in these smaller insectivores, although less distinct. It is, however, better marked in the shrew than in the mole.

FIG. 17.—The palatine rugæ of the Hedgehog (*Erinaceus europæus*).

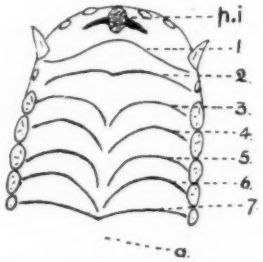

FIG. 18.—Diagram of the palatine rugæ of the common English bat (*Plecotus auritus*). *P.I.*—Papilla incisiva with its lateral offshoots. *A.*—The posterior limit of the hard palate.

CHEIROPTERA.

Plecotus auritus (fig. 18).

The common English bat has very simple and regular rugæ, occupying nearly the whole of the hard palate. They are seven in number, and there is a complete absence of rudiments or irregularities, the rugæ of one side corresponding readily to those on the other side of the palate. There are no papillæ either on the rugæ themselves or on the palate, and the edges of the folds are quite smooth and free from dentation. All are bow-shaped, the curvature being greatest in Nos. 4 and 5, and the convexity is, as usual, anterior. The direction of the first two may be said to be vertical, while the remainder have their anterior slope slightly more abrupt than the posterior.

The papilla incisiva is relatively large and has lateral off-shoots, which have the appearance of being attempts at the formation of regular folds.

The first well-developed fold starts on a level with the canine tooth, and, curving very slightly forwards, meets and becomes blended with its fellow. The second, situated close behind the first, has a somewhat greater curvature and also meets its fellow, but before doing so its median end is produced slightly backwards. The third, fourth and

fifth are separated at the middle line from those of the opposite side, and increase in size as the palate widens. The sixth meets, but does not become blended with its fellow; while the seventh, whose curvature is not so great, is joined at the median raphe.

The rugæ of this bat are peculiar in having the median extremities of all, except those of the two first and the last, continued backwards for some considerable distance beyond the level of their lateral ends. They also taper as they near the middle line. All the folds are about equidistant apart. The palate is remarkably concave laterally.

Vespertilio capensis.

With the exception of one or two minor details the palate of this South African bat is identical with that of Plecotus. The median extremities of the rugæ are not situated quite so far apart, nor are they so tapering or continued so far back. On the whole, the folds are not so regular in their disposition, and the last is not well developed, its lateral end being separated by some little distance from the gum.

The papilla incisiva is prominent, and, like that of Plecotus, is situated at the most anterior part of the palate. Its lateral projections (mentioned as occurring in Plecotus) are very conspicuous, and not unlike the folds found in a similar position in the rabbit and hare.

Pteropus medius (fig. 19).

This fruit-eating bat has an arrangement of palatine rugæ unlike those of the small insectivorous bats, or of any other mammal that I have examined. It has, in all, twelve folds, the first four differing entirely in their appearance from the rest. On a level with the incisor papilla are three abortive attempts at the formation of rugæ. Immediately behind the incisor papilla is the first of the well-developed and characteristic folds.

The first four rugæ are thickest at the middle line, where they are completely blended with their fellows. Followed from the middle line they taper, gradually at first, but afterwards more abruptly, their lateral extremities passing well to the side of the palate, and two of them insinuating themselves between the teeth.

FIG. 19.—The hard palate of *Pteropus medius*, showing the complex structure of the anterior rugæ.

FIG. 20.—Showing the palatine rugæ of *Epomorphus gambianus*.

Each ruga, moreover, appears to consist of two parts, which have become blended. On the whole their free borders are inclined slightly backwards, and in places are dentate, but towards the lateral extremities of the first and second the free border looks forwards. The fourth ruga is more simple and slightly less prominent. The part of the palate occupied by these characteristic rugæ, *i.e.*, as far back as the second cheek tooth, differs from the rest in being perfectly flat, except between the rugæ, where it is even convex from side to side. The remainder of the hard palate measures 17 mm. (total length of palate = 35 mm.), and has the usual concavity from side to side. Situated on this part of the palate are eight rugæ, the first of which is placed between the second and third cheek teeth and is thick, fairly prominent and non-dentate. Its lateral end continues some distance backwards alongside the gum. Its median extremity tapers considerably, and like all those on this part of the palate, is separated from its fellow at a median raphe, indicated by a well-marked groove. The succeeding four ridges are much the same in form, except that they are not so prominent and are all dentate. The next two ridges are straight and extend, at a more or less acute angle, from the median raphe to the gums. The last ruga is very rudimentary, is serrate, and, what is most remarkable, is situated just on the soft palate. This is the only animal in which I have noticed this peculiarity.

Flower and Lydekker (4) remark that, in the Megacheiroptera, "the bony palate is continued behind the last molar, narrowing slowly backwards." This is noticeable in the specimen under consideration, the hard palate measuring 35 mm., and that part of it occupied by teeth, 29 mm.

Epomorphus gambianus (fig. 20).

The difference between the palatal rugæ of this fruit-eating bat and *Pteropus medius* is so great as to merit a somewhat detailed description. Sclater (5) makes use of the difference in the rugæ of this animal and of *E. erypturus* for purposes of classification, stating that the *E. gambianus* has the fifth palatal ridge simple and divided, while in the *E. erypturus* it is rhomboidal and hollowed out in the centre.

In describing the *E. gambianus* in detail he says: "The roof of the mouth has six palate ridges, the first placed just behind the canines with a slight triangular projection in the centre of the posterior margin; second, third and fourth, simple and undivided transversely, the fourth being opposite the first molar; the fifth and sixth being divided by a narrow transverse incision into two half ridges."

The first three rugæ have their posterior slopes more abrupt than the anterior, so that their free border is directed backwards. The fourth, fifth and sixth, on the other hand, and especially the fifth and sixth, slope well forward. As stated by Sclater, the fifth and sixth do not blend at the median raphe with their fellows from the opposite side. The sixth in the specimen examined is irregularly dentated.

In addition to these rugæ described by Sclater, there are three others and a vestige of a fourth, all rudimentary, and not unlike the posterior rugæ of *Pteropus medius*. They are finely dentated, directed forwards, and very close together. The part of the palate upon which

they are situated is raised considerably above the general level, and between this raised part and the sixth ruga the palate deepens.

Concerning the physiological function of the rugæ of the bats, Dobson (10), in describing their method of eating figs, says: "While thus encircled by the lips the fruit is probably slowly chewed by the feeble, acutely-pointed teeth, and pressed upwards against the prominent palate ridges so as to cause it to give up more freely its juices and soft contents, which are drawn out by suction through the terminal aperture." The arrangement of the palatine rugæ is undoubtedly well suited to the mode of feeding, but there seems to be no feasible explanation of why the posterior rugæ should slope so markedly forwards.

The median raphe is in the form of an indistinct ridge on the anterior part of the palate, but posteriorly it is absent, except where indicated by a broad ridge caused by the union of the superior maxillary bones.

PRIMATES.

The monkeys which I have examined show a large amount of variation in the form of their palatine rugæ. The number has, unfortunately, been very limited, but such palates as have been seen are of interest in their relation to that of man. The marmoset's rugæ have the least likeness of any to those of man, being regular and relatively well developed. The rugæ of the monkeys which most resemble those of man were found in *Ateles ater* and *Nyctipithecus trivirgatus;* but even these differ very markedly, in that they occupy nearly the whole of the hard palate, whereas in man—as stated by Harrison Allen—rugæ are never found behind the first molar tooth. The same writer remarks that in man "the median part of the fold, as a rule, is crescentic in outline with the convexity directed forwards. The lateral (end ?) is directed forwards." This condition is well shown in both *Ateles* and *Cebus* (figs. 21 and 23), where some of the folds have a double curve; medially convex anteriorly, laterally convex posteriorly.

For literature on the palatine rugæ of man I refer the reader to Carl Gegenbaur (1), Harrison Allen (2), and Ambrose Birmingham (11).

Hapale jacchus.

The common marmoset has fairly well-developed and regular rugæ. They differ from those of the other monkeys examined, not only in their regular and symmetrical formation, but also in that they do not occupy quite the whole of the hard palate. There are, moreover, practically no rudiments and there is a total absence, on any of the folds, of dentation, such as is present on the last two or three of some of the other monkeys. The rugæ are all situated at about an equal distance apart, and the hindermost is, in places, as prominent as the anterior ones—an arrangement not usual. There is a small additional fold placed between the incisor papilla and the incisor teeth, with both of which it is in contact.

The first regular fold starts on a level with, and touching the canine tooth. Passing to the middle line it blends with its fellow at the posterior border of the incisor papilla, and, at the point of junction,

Each ruga, moreover, appears to consist of two parts, which have become blended. On the whole their free borders are inclined slightly backwards, and in places are dentate, but towards the lateral extremities of the first and second the free border looks forwards. The fourth ruga is more simple and slightly less prominent. The part of the palate occupied by these characteristic rugæ, *i.e.*, as far back as the second cheek tooth, differs from the rest in being perfectly flat, except between the rugæ, where it is even convex from side to side. The remainder of the hard palate measures 17 mm. (total length of palate = 35 mm.), and has the usual concavity from side to side. Situated on this part of the palate are eight rugæ, the first of which is placed between the second and third cheek teeth and is thick, fairly prominent and non-dentate. Its lateral end continues some distance backwards alongside the gum. Its median extremity tapers considerably, and like all those on this part of the palate, is separated from its fellow at a median raphe, indicated by a well-marked groove. The succeeding four ridges are much the same in form, except that they are not so prominent and are all dentate. The next two ridges are straight and extend, at a more or less acute angle, from the median raphe to the gums. The last ruga is very rudimentary, is serrate, and, what is most remarkable, is situated just on the soft palate. This is the only animal in which I have noticed this peculiarity.

Flower and Lydekker (4) remark that, in the Megacheiroptera, "the bony palate is continued behind the last molar, narrowing slowly backwards." This is noticeable in the specimen under consideration, the hard palate measuring 35 mm., and that part of it occupied by teeth, 29 mm.

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The first regular fold starts on a level with, and touching the canine tooth. Passing to the middle line it blends with its fellow at the posterior border of the incisor papilla, and, at the point of junction,

becomes projected slightly forwards. The conjoined rugæ have the shape of a bow, with the convexity anteriorly. The second likewise becomes blended with its fellow, but its curvature is decidedly less, and it passes in an almost straight line across the palate. The third ruga, situated at a slightly greater distance from the second than the second is from the first, has a somewhat greater curvature, and it tapers considerably towards the middle line, where it meets its fellow, but does not become so completely blended with it as do the two preceding.

The remaining three rugæ differ from the others in being completely isolated from their fellows. The sixth has its median extremity at a more anterior level than its lateral end. The median extremities of the last three rugæ are considerably thinner than the lateral ends; and on the right side, close to the middle line, there are three small projections of the mucous membrane, which are apparently cut off these extremities.

The first four folds have their posterior slope more abrupt than the anterior, while in the fifth and sixth there is a decided tendency for the rugæ to be inclined anteriorly. That part of the palate on which are the rugæ which do not meet at the middle line, is markedly more concave laterally than the anterior part, which is flat, or nearly so.

Cebus capuchinus (fig. 21).

Cebus has palatine rugæ, which differ in many points from those of *Hapale jacchus*. It may be said to have nine folds of good size, besides a rudiment or two.

By no means the least important difference between the rugæ of this monkey and those of *Hapale* is that all the rugæ—with the exception of the first—have their anterior slope more abrupt than the posterior, which is not defined accurately from the inter-rugose palate. The first ruga blends, though incompletely, with its fellow. The remainder, in most cases, reach the middle line (which is indicated by a groove posteriorly and a ridge anteriorly), where they become gradually less marked and indistinct. In the anterior half of the palate the median and lateral ends of the folds are on about the same level, but farther back the median ends are the more posterior. All the rugæ, with the exception of the last two or three, are perfectly smooth and free from dentation or papillæ. The most posterior ruga is exceptional, in having its summit dentated and inclined backwards. It is placed on a level with the last cheek tooth and marks the posterior limit of the hard palate. On the whole, the rugæ may be described as thick—especially at the sides—and placed rather close together.

Nyctipithecus trivirgatus (fig. 22).

In this monkey the rugæ bear no similarity to either *Hapale* or *Cebus*. They are very irregular, not at all prominent, and, though not well developed, are sharply defined, especially anteriorly.

Like those of *Cebus*, however, nearly all have the anterior slope more acute than the posterior; but this is not so well shown as it is in the other two monkeys on account of the lack of development.

With the exception of intercalated rudiments (of which there are three), the rugæ number seven, the first being the only one which blends with its fellow. The first and the second are vertical, all the

rest sloping forwards. The first four, and the greater part of the fifth, are perfectly smooth. The sixth, seventh, and a small portion of the lateral extremities of the fifth, are coarsely dentated, the dentation being faint on the fifth and very deep on the last ruga. The last ruga, moreover, extends right across the palate, meeting its fellow at the

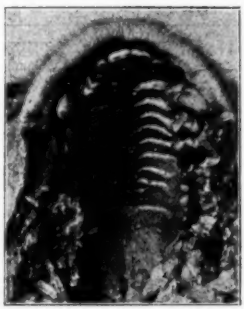

FIG. 21.—The palatine rugæ of *Cebus capuchinus*, showing their forward inclination.

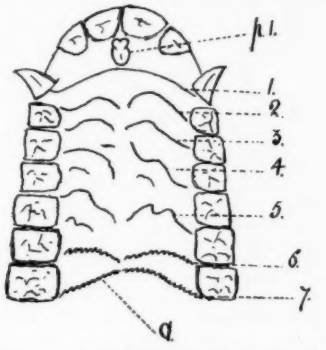

FIG. 22.—*Nyctipithecus trivirgatus.* Showing the irregular formation of the rugæ and the dentate character of the last two. *P.I.*—Papilla incisiva. *A.*—The posterior limit of the hard palate.

middle line. It marks precisely the posterior limit of the hard palate, which is on about a level with the last cheek tooth. The dentation of this fold, unlike that of *Cebus*, is directed towards the front of the palate.

The median raphe between the first and second rugæ is indicated by a ridge, and posterior to this by a groove. The palate is sharply concave from side to side.

FIG. 23.—The palatine rugæ of *Ateles ater*.

Ateles ater (fig. 23).

There is nothing of sufficient importance in the palatine rugæ of the spider monkey to merit a detailed account. They closely resemble those of *Nyctipithecus*, and, as shown in fig. 23, are very irregular and not at all prominent. In all cases they are vertical. Unlike those of

Nyctipithecus, they do not occupy quite the whole of the hard palate, but stop on a level with the fourth cheek tooth. The hindmost fold is not so well developed as the others and is coarsely but faintly dentated. The last four or five have slight indications of being dentated, but in the case of the one situated between the first and

TABLE OF MEASUREMENTS OF PALATES OF VARIOUS MAMMALS.

Name of Animal	Total length of Hard Palate	Index of Length of Palate invested with Rugæ	Index of Length of Palate upon which are no Rugæ	Number of Rugæ most commonly found
Didelphys azaræ ...	65 mm.	86·15	13·85	9
Orycteropus afer ...	133	83·45	16·55	13 + 13 secondary ridges*
Dasypus sexcinctus ...	55	80·00	44·00	8*
Equus caballus, adult	328	94·72	5·07	16—18
,, ,, newborn	130	94·00	6·00	16—18
,, asinus, adult ...	195	94·83	5·17	17*
Sus scrofa, adult ...	129	90·14	9·86	23—25
Bos taurus, adult ...	250	68·28	31·72	16—17
,, ,, newborn	113	84·07	15·93	16—17
Ovis aries, adult ...	113	66·66	33·34	16—17
,, ,, newborn	64	70·31	29·69	16—17
Antidorcas euchore...	49	79·59	20·41	16—17*
† Camelus bactrianus (aborted fœtus)..	110	61·81	38·19	12*
Mus decumanus ...	25	92·00	8·00	8
M. musculus... ...	10·5	85·71	14·29	8
Microtus amphibius	28	92·85	7·15	8
M. agrestis	14	92·85	7·15	8
Myopotamus coypu ...	52	difficult to	determine	
Sciurus vulgaris ...	25	100	—	10
Lepus cuniculus ...	33	100	—	15—16
L. timidus	29	100	—	14*
Procavia capensis ...	48	93·75	6·25	12
Felis leo	156	85·25	14·75	8*
,, domestica, adult	36	81·85	18·15	9
,, ,, newborn	16	81·25	18·75	9
Canis familiaris, adult	83	82·66	17·34	9
,, ,, newborn	25	84·01	15·99	9
,, ,, (pug)...	50	86·00	14·00	9*
Herpestes mungo ...	35	17·11	22·89	9*
Mustela vulgaris ...	16	75·00	25·00	7
M. erminea	16	68·75	31·25	7
Erinaceus europœus	31	90·32	9·68	9
Talpa europœa ...	15	86·66	13·34	8
Sorex vulgaris ...	9	94·44	5·56	10
Plecotus auritus ...	17·5	97·14	2·86	7*
Vespertilio capensis	6·5	100	—	8*
Pteropus medius ...	37	105·40	—	12*
Epomorphus gambianus ...	30	100	—	9*
Cebus capuchinus ...	30	100	—	9*
Nyctipithecus trivirgatus ...	19	100	—	7*
Ateles ater	33	89·39	10·61	8*
Hapale jacchus ...	17	82·35	17·65	6*

* Measurements are unconfirmed.

† Camelus bactrianus, the measurements are doubtful.

second cheek teeth, only at the median extremity. All the rugæ become somewhat finely pointed at the median raphe, which some of them reach, though none pass over to blend with their fellows from the other side.

The posterior limit of the hard palate is marked by a slight transverse elevation. The median raphe is in places indicated by a low ridge, but this is quite absent posteriorly.

Like those of *Cebus*, the rugæ are distinct, though not very prominent, and there are, relatively, large flat intervals between them.

General Conclusions.

The foregoing observations may be summarised as follows:—

The first point to which attention should be called is the remarkable similarity which is found in the rugæ of members of entirely different sub-orders, and the great dissimilarity which may exist among the members of the same sub-order. For instance, the armadillo and the hedgehog—though widely separated zoologically—have palatine rugæ of close resemblance; on the other hand, the different subsections of Rodentia supply numerous examples of marked disagreement in the arrangement of the rugæ of closely-allied animals. We find that those animals with no zoological relation, but which agree in the general form of their rugæ, live mainly on the same kind of food (the armadillo and hedgehog may be cited as examples), and where one section differs from others of the same sub-order there is a difference in the character of their food.

The Lagomorphs differ, to a very great extent, from the remaining rodents, in the general morphology of their rugæ. The rabbit and hare feed mainly on such grasses as the larger herbivores, and their rugæ agree closely with those of the sheep. On the other hand, the Myomorphs have characteristic rugæ, and their food differs, to a certain extent, from that of the Lagomorphs.

In herbivorous animals, such as the ox, sheep, rabbit, &c., the rugæ are well developed, placed close together and flattened, apparently to give the greatest amount of roughened surface upon which the food may be manipulated.

The hedgehog and others, whose food is similar, have prominent, somewhat sharp-edged rugæ, placed some distance apart, and obviously of great assistance to the animal in retaining within the mouth such food as a worm or an insect. So it may be concluded that in all animals the palatine rugæ are so modified as to be of the greatest use to the animal when feeding.

There are some forms of rugæ for the peculiar conformation of which it is difficult to assign a reason. For example, the complex rugæ at the anterior part of the palate of *Pteropus medius* do not seem to be better fitted for their function than do those—much more simple—of Epomorphus: and yet both animals are fruit eaters.

It is quite clear that the great majority of animals have the rugæ directed towards the back of the palate, and this arrangement seems to be the best if their function is to aid in the feeding process. At the same time there are many instances where the posterior rugæ are directed forwards; and others, again, where all the folds are so directed. No hypothesis of sound basis has suggested itself to explain this peculiarity.

Another point of interest is the difference found in the rugæ of

certain ruminants, notably the ox and sheep. In the main these folds are similar, but those of the ox are richly and finely dentated, while those of the sheep are perfectly smooth. The Spring-buck agrees with the ox in this respect. All three, however, feed on the same class of food, except that the sheep naturally feeds on higher pastures where the grass is shorter. Furthermore, the posterior rugæ of these three animals are practically identical and entirely free from dentation or papillæ. It is frequently the case that animals with their main rugæ devoid of dentation have their posterior ones dentated—sometimes finely and at other times coarsely.

In all cases the best-developed and most prominent folds are those situated at the front of the palate, and, in the majority of cases, these well-developed rugæ become blended with their fellows from the other side, or else are so placed that they alternate and have their median ends passing over the middle line (*e.g.*, pig).

The folds at the back part of the palate, on the other hand, often not so well developed as those in front, usually fail to reach the median raphe, or, if they do reach it, do not become blended with their fellows.

Harrison Allen states that the best-developed ruga is that situated on the premaxillary and maxillary suture, and he calls it the "sutural ruga;" moreover, he divides the rugæ into two sets, the pre-sutural and the post-sutural. His statement that the sutural ruga is always better developed than the others is not to be supported by an examination of a number of diverse forms. For instance, it is quite impossible to say that any one ruga in the sheep is better developed than the remainder. In the dog the "sutural ruga"—to use Harrison Allen's term—is certainly very conspicuous, but the one immediately behind it is not less so. I see no reason why he should divide the rugæ into two sets. Where his sutural ruga is better developed it is solely because of the prominence of the bony palate, caused by the meeting of the premaxillary and maxillary bones, the ruga itself being not larger than any of the others in the vicinity.

For the greater part of the material used for the foregoing observations I am indebted to my greatly respected teacher, Professor Charnock Bradley, under whose supervision these notes have been compiled. My thanks are also due to Principal Dewar and to others who have kindly assisted me in obtaining material.

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VETERINARY TOXICOLOGY.

BY LIEUT.-COLONEL NUNN, F.R.C.V.S., F.R.S.E., C.I.E., D.S.O., BARRISTER-AT-LAW, AND FORMERLY DIRECTOR-GENERAL ARMY VETERINARY DEPARTMENT.

(*Continued from p.* 204.)

Digitalis and Digitaline.

The digitalis belongs to the natural order *Scrophalariaceæ* and the most common variety is the digitalis purpuræ. It is about 2½ ft. high, leaves oval and crenulated, brown on the upper and white and downy on the lower surface, flowers pink or purple, the carolla gamopetalous in the form of the finger of a glove, fruit an ovoid capsule with numerous small pale brown seeds. The plant grows in woods, on low hills, in dry, sandy uncultivated places, but will not live on chalk. The different parts, but more particularly the leaves, contain the active principle digitaline.

This alkaloid was first discovered in 1843 by Homolle and Quevenne, but the method of preparation was modified by Nativelle who obtained it in a crystalline form slightly soluble in water, to which it imparts a distinctly bitter taste. In addition to digitaline the plant contains digitaleine, digitoxine and digitine, which all have toxic properties. Animals are usually poisoned by the plant getting mixed with the forage.

Digitaline is a nervo-muscular poison, and after a preliminary stage of excitement causes paralysis, more especially of the heart, death taking place from stoppage of this organ. It is not determined how absorption and elimination take place, but both are slow processes. Dragendorff has found the alcaloid in the urine.

The carnivora are the most sensitive to its action, and the fatal doses of fresh leaves are given by Stourba as :—

Horse	...	...	...	...	120	to	140	grammes.
Ox	...	...	...	...	160	„	180	„
Sheep	...	...	...	...	25	„	30	„
Pig	...	...	...	...	15	„	20	„

The dried leaf is about a fourth less powerful. The dose of digitaline is :—

Horse	...	...	...	...	15	centigrammes.
Dog	...	...	...	...	2	„
Cat	...	...	...	...	1	„

Symptoms.—Bouley and Reynal have made some observations on poisoning with digitaline. About six to eight hours after taking the plant, there was dulness, depression, loss of appetite, followed by excitement, the mucous membrane were infected, nostrils dilated, the eyes bright and glistening, the face pinched, and the respiration and circulation quickened, the beats of the heart being very violent. There is colic, the animal getting up and down, scraping the ground with his fore-feet, and profuse perspiration. After about twenty-four to thirty-six hours coma sets in, the head is hung, and the eyes are haggard, pupils dilated, and the walk staggering. There is extreme weakness, and the animal falls down. The respirations and the heart-

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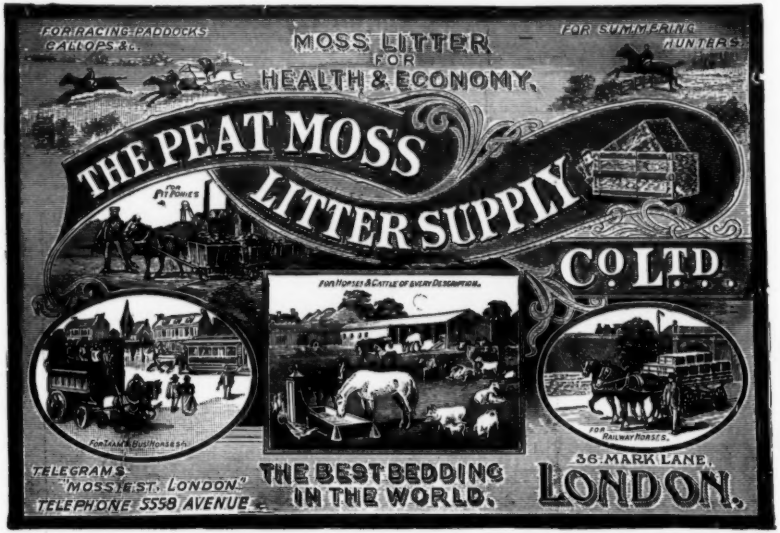
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The "COUNTY GENTLEMAN," *April* 1, says: "Chief among the merits of Peat Moss are the ease with which it is stored; the small danger it offers as regards fire compared with Straw; non-conductivity; the great powers of absorption; its antiseptic properties, and the ease and advantage with which it can be used as Manure in town gardens and in the country."

Poisonous doses.—The toxic doses of the leaves vary according to the condition of the digestive system and the degree of tolerance of the animal, which appears to acquire an immunity. Virborg reports that in Hesse the farmers, in times of scarcity, accustom their animals to yew leaves, by giving them mixed in the food, and in time they are able to take large quantities. Baillet for thirty days gave a medium-sized ox 24 kilogrammes of yew leaves daily without any ill result, and Philippeaux for sixty days gave a rabbit 5 grammes daily with the same result. Virborg also says that the plant is only toxic when taken on an empty stomach, when mixed with other forage it is harmless.

Cornevin gives the poisonous dose per kilogramme of live weight as:—

Horse	2 grammes.
Ass and mule	1·60 ,,
Cow and sheep	10 ,,
Goat	12 ,,
Pig	3 ,,
Dog	8 ,,
Rabbit	20 ,,

Symptoms.—If the quantity taken is large, death generally takes place suddenly, in from one to six hours after partaking of the leaves. If the quantity is small, there is uneasiness and gastro-enteritis, with nausea, vomiting, collicky pains, tympanitis, and very fœtid diarrhœa. The state of excitement is rapidly succeeded by one of depression, the pulse is small, weak, and almost imperceptible, the respiration slow, the temperature falls, the senses become dull, and the patient sinks into a comatose condition, dying in convulsions. The symptoms may last from half to two hours, or more, but when death does take place it is sudden.

Post mortem.—The *post-mortem* appearances present nothing special. There may be patches of ecchymosis in the pharynx and œsophagus, and gastro-enteritis with petechia and dark-brown patches of effused blood. In some cases there is enlargement of the liver, which has a dark-yellow colour.

Treatment.—In most cases death takes place so quickly that treatment is of no use. If there is time, purgatives should be given, with demulcents, such as linseed gruel, milk, &c., and stimulants, such as coffee, alcohol, camphor, &c., to counteract the narcotic effects of the poison.

Chemical analysis.—The leaves are found in the stomach and can be recognised by their characteristics.

The active principle "taxine," according to Marme, is soluble in alcohol, ether, chloroform, and benzine, which, when evaporated, leaves behind crystals that turn red with sulphuric acid, but this test is uncertain, and there are probably other substances that act in a similar manner.

Ranunculaceæ.

The green Ranunculus, which is found in wet places, is poisonous, and the most common varieties are *Ranunculus sceleratus*, *R. acris*, *R. bulbosus*, *R. flammette*, or small spear wort, *R. langue*, or large spear

wort, and *R. thora*, which is the most dangerous of all, *R. rampanti*, and *R. ficaire*. The poisonous properties of the plant increase with age, and attain their maximum when it is in flower. Drying diminishes them.

The active principle appears to be a compact substance, but M. S. Martin has found a very bitter volatile acid that he terms ficaric acid.

Symptoms.—The symptoms are those of gastro-enteritis, with grinding of the teeth, eructation, nausea, vomiting, colic, and black, fœtid diarrhœa. There are brain symptoms resembling those of cerebral congestion, the animal hanging back in the halter, or pressing forward against the wall, crouching down on his haunches; there is frothing at the mouth, dilatation of the pupils, loss of vision, stertorious breathing, and weak, feeble pulse. If the case is a fatal one there are convulsions, the animal bellows, the eye is retracted into the socket, he falls down, and dies in a convulsed condition.

Treatment.—Symptoms have to be treated, particularly the gastro-enteritis and cerebral congestion. The antidote is tannin.

Field Fennel (Agrostemma Githago).

The plant belongs to the natural order of *Caryophyllaceæ*. According to Malepert the active principle is saponine, a white glucocide powder, inodourless, with at first a sweetish taste, that afterwards becomes acrid and styptic. It produces violent sneezing, and is soluble in water, which it makes froth up.

The seeds are sometimes found in large quantities mixed with the rye, and will give rise to poisoning, which is chiefly seen in the horse, cow, pig, and poultry.

Both acute and chronic poisoning may be seen, depending on the quantity taken; the latter in the form that usually attacks the pig, as this animal can vomit.

The active principle is a local irritant, giving rise to violent inflammation of the intestines. It is absorbed slowly, causing paralysis of the voluntary muscles and reflex nervous action.

According to Cornevin, the poisonous dose per kilogramme of live weight is:—

Calf	...	...	...	2·50 grammes.
Pig	...	...	...	1·06 „
Dog	...	...	...	0·90 „
Fowl	...	...	...	2·50 „

Symptoms, Acute.—There is salivation, yawning, colic, and a greyish-coloured fœtid diarrhœa. The respirations and pulse are rapid, the latter small and nearly imperceptible; the temperature rises, and there are muscular tremors. Paraplegia and inco-ordinate movements of the limbs supervene, the respiration and circulation gets weaker, and the temperature at this stage falls below normal, death taking place from heart failure.

Chronic.—Beyond general and progressive weakness with chronic diarrhœa, there is nothing distinctive.

Treatment.—Is entirely symptomatic, the gastro-enteritis must be treated, and the general paralysis counteracted with stimulants, good grooming and wisping are recommended.

Analysis.—It may be necessary to examine contaminated flour, which will contain a number of brown pellicles. Where these are treated with a boiling solution of chloride of lime and mounted in glycerine, they appear as dark-brown cells with an irregular dentated edge, studded over with small black points, and a light centre sur rounded by a darker coloured belt (Cornevin).

The starch has peculiarities, being only 1 to 2 μ in diameter, whereas wheat starch is $1\frac{1}{2}$ to $3\frac{1}{2}$ μ. The granules are very resistant to the action of potash, and do not readily give a blue colour with iodine, but with sulphuric acid turn a brownish-green, which changes to blue, violet and red.

(*To be continued.*)

Translations and Extracts.

MOVEMENTS OF THE QUARTER IN LAMENESS OF THE HIND LIMB OF THE HORSE.

BY M. LANAUD, AIDE-VETERINAIRE CAVALRY SCHOOL, SAUMUR.

THERE have been many opinions given as to the movements of the quarter in lameness of the hind leg, which may for convenience be classified under three headings—viz., (1) elevation of the quarter on the lame side; (2) depression; (3) elevation followed by depression.

(1) The earlier writers, being aware of the fact that in lameness on a fore limb the head is raised at the moment the lame limb comes to the ground, were led away into thinking that the same took place with the hind ones. Jecoq, in 1847, in his work, "Traité d'extérieur du cheval," says: "When a horse is lame on a hind leg, the quarter is raised at the moment the foot comes to the ground, in order to diminish the weight that otherwise would be thrown on it; and at the same time the head is depressed, which throws a considerable portion of the weight of the hind quarter on to the fore limbs." This view has been taken by many authorities—viz., Marche, 1868; Zundel, 1874; Gourmel, 1893; Le Hello, 1896; and Dubois, 1899.

(2) The author of the theory of the quarter dropping is M. H. Bouley, who, in the "Nouveau Dictionnaire pratique," 1866, states in the article on "Lameness": "The dropping of the quarter is most marked when the sound limb, on which most of the weight is thrown, comes in contact with the ground; it is hardly natural with the lame one." He, however, qualifies this rule by mentioning numerous exceptions depending on the cause and seat of the lameness. Goubaux and Barrier, 1890, Jacoulet and Chomel, 1900, Cadiot and Almy, 1901, and Cagny and Gobert, 1904, with a few slight differences, endorse Bouley.

(3) Between these three theories is that of M. Lemichel, of the Military School of St. Cyr in 1872, according to whom, "The quarter on the lame side is at first raised on account of the pain caused by the contact of the limb with the ground, and then drops, to relieve the pain caused by tension in sustaining the weight thrown on it." He further says that this double movement is subject to variation from the nature and degree of the lameness.

All these writers commit the error of trying to lay down a hard and fast rule on insufficient grounds. The movements of the quarter vary not only with the seat of lameness, but with the degree to which it exists. If at its commencement the lameness is very painful, the quarter will be raised at the moment weight is put on the limb, whereas later on, although the movement may be the same, there is little or no pain, and it is then distinctly dropped.

Another error is the loose way in which the point of sight is selected to observe the motion of the quarter, and the terms "croup," "haunch," and "summit of the croup" are used. To be correct, the internal angle of the ilium should be kept fixed in the eye. The external angle has a much greater degree of movement, but leads to errors being made on account of the distance from its fellow, and the impossibility of keeping both in view at the same time. When speaking of the "croup," the author applies the term to the internal angle of the ilium.

The movements of the sound quarter have been recorded by Marey, and they differ at the walk and trot.

At the walk, at the moment the foot is put to the ground, the croup at first drops, and then slightly rises, just before the greatest amount of weight is put on the limb, when it again drops till it is lifted off the ground; it then again rises and drops, as sure as weight is again put on the leg.

At a trot, the croup drops from the time the foot comes in contact with the ground till the greatest weight is placed on it. It then gradually rises till the highest point of "*suppression*," *i.e.*, the time the limb is off the ground, is reached, and drops again with a slight rise in the curve to the end of the period of suppression.

There are, therefore, at the walk three rises and two falls, and at the trot a sharp fall followed by a similar rise.

The movements of the croup at the moment weight is thrown on the lame leg vary, depending on the pace, whether walk or trot; at each it is necessary to ascertain if, in addition to the lameness, the movements differ from the normal, and it is not sufficient merely to say that the croup rises or drops in an irregular manner on one side or the other, but it is necessary to compare the degree of variation with the movements of the opposite limb.

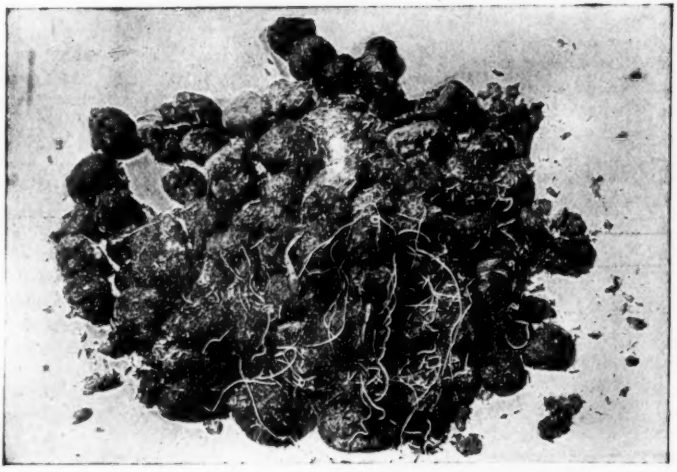
It is also necessary to distinguish true from relative dropping, the former being an exaggeration of the normal drop, the latter being a regular one in sequence, but less marked, corresponding with the motion of the opposite leg.

The next point to consider is the influence that the nature and seat of lameness have on the movement of the quarter.

M. H. Bouley points out that any forcible or painful distension caused through the medium of the attachments of the femur with the pelvis on the muscles that move the first bone or the second have the following effects. In injuries to this region the whole of the croup on the lame side drops at the moment any weight is placed on the limb, and the internal angle of the ilium is always lower on that side than its fellow on the sound one. The lame leg is moved with difficulty, and only the inferior articulations are flexed, allowing of a very short step being taken, the foot being dragged along the ground.

In paralysis of the anterior femoral nerve the triceps coralis muscle

THE UNIQUE CLAIMS OF MOLASSINE MEAL PROVED.



Photograph of a portion of the manure from "IRENE" before being fed with Molassine Meal.

It is a common thing for horse-owners and stock feeders to write to the Molassine Co., Ltd., pointing out how much better some other foods are from an analytical standpoint than Molassine Meal.

The reply is, that **it is not what an animal eats, but what he digests,** that is of service. If horse-owners and others would but examine the manure in their stables, they would often find that a large proportion of the food given to animals passed through in an undigested state, and that its money value might just as well have been thrown away. This represents a serious loss during the course of a year, and the intelligent stock-feeder should give it his careful attention.

The photograph represents manure from "Irene," before feeding on Molassine Meal, and it will be seen that it contains a large proportion of oats and beans which have come from the animal just as they were eaten.

The photograph shows that the oats and beans had begun to germinate, and distinct growths of oats and beans are to be seen, showing clearly that on account of the low vitality of the animal, fermentation and other stomach troubles had set up, which affected the digestive organs and made them incapable of performing their proper functions.

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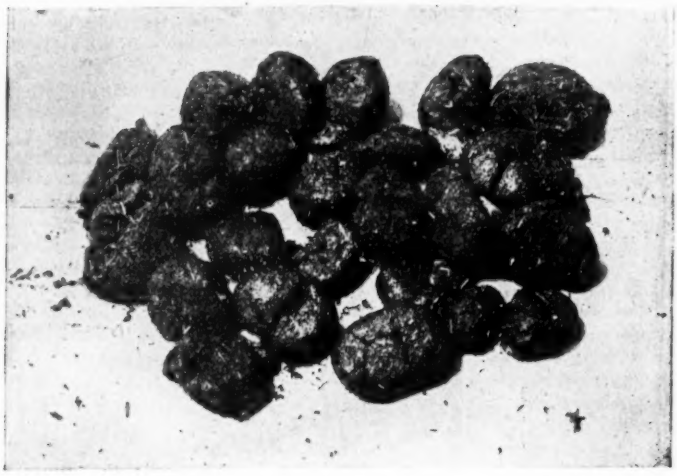

Photograph of Manure from "IRENE" after feeding with Molassine Meal.

This photograph shows manure some weeks after "Irene" had been fed on Molassine Meal, and after it had lain sufficient time for germination to take place in case there had been any undigested grain pass through. It is quite free of any cereals and is perfectly healthy and inodorous, showing that Molassine Meal has had its usual effect upon the stomach and digestive organs, and had brought the animal to a perfectly healthy condition, **and able, as we claim, to obtain the full amount of nutriment of his entire food,** to the financial benefit of the owner.

Another mistake buyers sometimes make is that they attempt to compare the value of Molassine Meal with cake or other food. Our answer invariably is, that you cannot compare Molassine Meal with any other food, as there is no comparison. **It is not only its actual feeding value, but the tremendous additional value it gives to all other foods, in consequence of its antiseptic and digestive properties.**

Horse-owners and stock-feeders can test this feature for themselves, when they will have the same results.

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which extends the tibia on the femur, is implicated, and at the moment the limb is put to the ground the croup drops very low, and remains in that position during the time the step is being made.

Injuries of the stifle joint give rise to a slightly greater elevation of the internal angle than its fellow.

Luxation of the patella increases dropping of the croup, which is permanent, the limb being extended posteriorly.

Punctured wounds in the muscles of the thigh cause extreme elevation of the croup. Wounds in these muscles are very painful when they are moved; the animal places the leg in the easiest position, and any movement forward to bring the foot to the ground gives rise to great suffering. The limb is kept stiff, and moved in one piece without any flexion of the joints, and at the moment it comes to the ground the croup is at its extreme point of elevation. As the case improves and the degree of lameness decreases the quarter drops.

The movements in hock lameness are peculiar; there is a downward and forward movement of the croup, diminution of flexion in the hock and increase of it in the fetlock joint. The croup is not dropped in injury to the fetlock, at all events in the earlier stages. The limb rests on the toe of the foot, so that it is longer than natural. In the later stages, as the pain decreases, the croup is lowered. Ringbone lameness causes the croup to drop.

Injuries to the foot, especially at the posterior part, cause elevation of the croup, which is more particularly marked when the weight is put on the toe.

The conclusions the author arrives at are: that the movements of the croup vary with different injuries and the region they are situated in, also with the amount of pain they give rise to. Severe injuries, especially those on the thigh, that give rise to pain when weight is put on the leg, cause elevation of the croup, and those that are not so painful, depression of it.

(*Revue Générale de Médécine Véterinaire*, April 1, 1905.)

PERFORATION OF THE LUNGS AND LACERATION OF THE PULMONARY ARTERY IN A HORSE FROM THE EXPLOSION OF A BOMB.

BY MM. G. BARRIERE AND J. PETIT.

(*Communicated to the Paris Central Veterinary Medical Society, June* 8, 1905.)

GENTLEMEN,—The late attempted assassination of His Majesty the King of Spain by a bomb thrown in the Rue de Roban by an anarchist is public property, and fortunately the only victim of the outrage is the horse ridden by one of the Republican Guards who was on escort duty at the time. The body of the animal, which was killed on the spot, was sent to the Alfort School on the morning of June 1 by the police authorities.

The abdomen was greatly distended, as the temperature was over

20 per cent., and the animal had been dead nine hours. On the left side at the posterior border of the olecranim muscles there was a circular wound, as if stamped out with a punch, about 18 millimetres in diameter, from which a little blood was oozing. At the orifice was a portion of tissue resembling the remains of a hank of cotton.

Over the tuberosity on the spine of the scapula there was a superficial contused wound, about 4 centimetres long, where the hair and epidermis had been scraped off, and a similar one at the upper part of the neck over the long oblique muscle.

The orbital arch was abraided and soiled with dirt, probably caused by the struggles of the animal, but no doubt some were inflicted in landing the body on to the knacker's cart.

There was some dried blood round the left nostril, lips, and end of the tongue, that was hanging out of the left side of the mouth. When the head was lowered a small quantity of blood flowed from the left nostril.

The upper lip was cut by the teeth when the animal fell on her head.

Under the skin around the circular wound there was a considerable amount of effusion in the substance of the left olecranium muscles, which were ruptured along the course of the projectile, and allowed of the passage of the hand.

There was a great deal of effused blood between the shoulder and chest wall, which extended into the olecranium and serratus magnum muscles.

The intercostal muscles between the fifth and sixth ribs were ruptured, also the pleura for about 5 centimetres, through which the hand could be passed into the chest. There was a longitudinal sphinctered fracture of the fifth rib.

The left side of the chest was then removed.

The left pleural sac contained a large blood clot that extended from the first rib back to the diaphragm. The posterior mediactinum was ruptured, and the blood had penetrated into the right side of the chest.

The left lung was penetrated by the projectile, also the pericardium and the sac were filled with a large blood clot.

The heart and lungs were removed, and the following lesions discovered:—

The pulmonary artery was perforated from one side to the other, which accounted for the hæmorrhage.

The right lung was wounded in a similar fashion to the left, also the right intercostal muscles between the fifth and sixth ribs, and the fifth rib was splintered.

The injuries on the right side after the fore limb had been removed were the same as on the left. The projectile was discovered in the large extensor muscle of the forearm.

There was a *post-mortem* rupture of the large colon caused by the accumulation of gas, through which the contents had escaped into the abdomen.

The projectile was no doubt the screw plug that closed the base of the bomb, and was about 20 millimetres in diameter.

(*Bulletin de la sonte centrale de medecine Veterinaire.*)

Reviews.

VETERINARY DIAGRAMS. By H. C. WILKIE, F.R.C.V.S., Veterinary Department of the New Zealand Board of Agriculture. Published by John Mackay, Wellington, New Zealand. Price 7s. 6d. each, on calico.

This series consists of three large sheets of sketches suitable for demonstration purposes, made by Mr. Wilkie for use in lectures on amateur veterinary science.

The first consists of the foot of the horse with superficial dissections and diagrams of the exterior, interior, and horny laminæ; the second of sections of the udder of the cow, ewe, and mare respectively, together with a diagram of the appearance of the gland tissue under the microscope; and the third of the bony skeleton of the horse in black and white shading.

As they measure about three feet by four they can be seen clearly by the students in any part of a large room, and we think that they will fulfil the purpose for which they are intended.

CATECHISM OF THE PRINCIPLES OF VETERINARY SURGERY. By W. E. A. WYMAN, M.D.V., V.S., New York. Published by William Jenkins. Price 15s.

This book, of some 310 pages, consists of a series of questions and answers on surgical diseases of the domesticated animals, and is intended for the use of veterinary students in America. Many of the phrases and terms are purely American, and would not be allowed in present-day up-to-date English literature. For example, we have a chapter (page 215) on "articular contracture," in which the following is asked: "Name the various forms of joint contractures." The reply which the student is to make is as follows: "(1) Arthrogenous contractures, (2) tendogenous, (3) myogenous, (4) neurogenous, (5) cicatricial, (6) congenital." The next question asks, "What are arthrogenous contractures?" whilst the reply is, "In these, pathologic lesions, in or close to the joint, hinder free mobility."

In the chapter on the treatment of wounds the aseptic method is very much discouraged, in fact it is stated that it simply cannot be executed. In reply to the question "To what extent is the aseptic method of wound treatment applicable in veterinary surgery?" the reply is, "In every-day practice it is not to be thought of; the surroundings are such that even should the desire exist to do antiseptic work it simply cannot be executed. Antiseptic treatment of wounds can be best demonstrated at the colleges, but to the average practitioner it only exists in theory."

On page 39 we find the student is asked to "Outline the antiseptic treatment of wounds," and after a short preamble, in which the author advises the casting of the patient on a bed of southern pine shavings sprinkled with 1 per cent. carbolic acid or permanganate of potash

solution, he states as follows: "Underneath the field of operation a clean rubber sheet is placed. This rubber sheet is of great practical interest, as it protects the field of operation against the invasion of bacteria from beneath, enabling the surgeon to operate almost anywhere. The hospital and college go one step further towards asepsis by providing operating tables—practically useless, theoretically ideal. The latest is Dollar's operating table. This medical contrivance upsets the mental equilibrium of any but the most decrepit old horse. The vast majority of horses cannot be gotten (*sic*) near it; those which you get into it almost invariably raise all sorts of disturbances before they are secured with a foot chain, belly strap, &c. In city practice it may be allowed to exist, but the country practitioner who experiments with it on farmers' horses which are but half broken, any way would get quite a collection of broken bones of the head, fore and hind limbs, to say nothing of the crushed fingers coming from the surgeon's anatomy."

From the above it will be seen that the author is not in love with an equine operating table, nor yet does it appear from the criticism that he has had much personal experience of it. "Tupfers" are suggested to dry wounds with, and we presume that this word is an Americanism for what is commonly termed in English "the antiseptic swab."

The style of the book is distinctly to be objected to for the purpose for which it is intended, as it is palpably an attempt (and a misleading one at that) to give the student a cram-book. The pathological and surgical theories described therein would certainly not be accepted by the present day Board of Examiners of the Royal College of Veterinary Surgeons, and the student who attempted to gain, or even supplement, his knowledge from this source, would find that he had acquired a great deal which it would distinctly be to his advantage to forget.

DISEASES OF CATTLE, SHEEP, GOATS AND SWINE. By G. MOUSSU (Professor at the Alfort College) and JOHN A. W. DOLLAR, M.R.C.V.S., F.R.S.E. 785 pages, 329 illustrations. Price 25s. net. Published by Gay and Bird, Bedford Street, Strand, W.C.

A book on the diseases of cattle has been very much needed by the English speaking practitioner, and the work which has just been published distinctly fills a gap.

Professor Moussu's name is well known in France as that of a man who is well versed in cattle pathology, whilst Mr. Dollar has done sterling work for the English-speaking practitioner by his translations and other publications; and the happy combination of authorship has produced a standard work far in advance of any which has ever been placed before the veterinary profession in England. It has the advantage of a large number of illustrations; the arrangement is good; the binding and finish reflect credit on the publishers, and we are sure that a second edition will be required in a very short time, as it is a book which is sure to find a place on every country practitioner's bookshelf.

REPORT OF THE VETERINARY OFFICER OF HEALTH TO THE MUNICIPALITY OF RANGOON FOR THE YEAR 1904-5.

Even in Rangoon we find the authorities are in advance of those of Great Britain in regard to an efficient system of inspection of live animals and of meat, particularly the latter.

In his report of the official year ending in May last, for which we are indebted to the Veterinary Inspector (Mr. Arthur Blake, M.R.C.V.S.), we read that in the abattoirs the number of animals killed was as follows:—

	1903-04.	1904-05.
Buffaloes	2,474	2,580
Bullocks	11,770	13,866
Cows	4,837	4,221
Calves	1,334	1,503
Sheep	8,274	10,143
Goats	31,768	36,739
Kids		2
Total ...	60,457	69,054

Great care was exercised in examining and passing animals for slaughter, thus ensuring a supply of meat of good quality. During the year 3,122 animals, or 4½ per cent. of those brought for slaughter, were rejected as being unfit, or not good enough for consumption. During the past year the whole of Burma has been visited by an outbreak of cattle plague of a most virulent type, the mortality from which has been something appalling; and at one time the greatest difficulty was experienced by the butchers to get a sufficient number of animals for slaughter.

In addition to the inspection of meat, the department deals with the licensing of hackney carriages and the animals which are kept to draw them, and during the year 310 gharries were brought up for being in bad order: 116 for plying with unpassed ponies, 91 for being driven by unlicensed drivers, and 5 for plying with rotten harness. In all these cases the licenses were revoked or suspended, according to the gravity of the offence.

We see glanders and farcy are met with there as well as in London, for the number of outbreaks of glanders dealt with during the year was 205 compared with 84 in the previous year. Of this number 7 cases were notified by the Conservancy Department and 32 by the S.P.C.A.

Several prosecutions were instituted for non-compliance with the Bye-laws under the Glanders and Farcy Act.

Though everything possible is being done in Rangoon to prevent the spread of this disease, very little, if anything, is being done in the province outside; and the consequence is that large numbers of glandered ponies are being brought in from the jungle.

A large number of carcases were rejected by the veterinary surgeon as unfit for human consumption, and the following table is of interest as showing the reasons for such rejections:—

Name of Disease.	Buffaloes.	Bullocks.	Cows.	Calves.	Sheep.	Goats.	Pigs.
WHOLE CARCASES—							
Anthrax	1	1	...	...	...	...	...
Cancer	...	1	...	...	...	...	...
Cattle plague	6	38	13	1	...	...	...
Cysticercus cellulosæ	...	...	...	...	...	...	1
Injuries, bruises, &c.	...	...	...	...	...	4	...
Jaundice	...	...	...	...	...	1	...
Poor condition	2	...	...	1	...	...	...
Septicæmia	...	1	...	...	...	...	...
Tuberculosis	1	43	2	1	...	...	1
HALF CARCASES—							
Cattle plague	...	...	1	...	...	...	...
Injuries	...	1	...	...	...	...	...
Tuberculosis	1	40	1	...	...	...	...
QUARTER CARCASES							
Abscesses	...	4	...	...	...	...	...
Tuberculosis	...	1	...	...	...	...	...
LUNGS—							
Abscess...	...	8	1	...	...	..	...
Congestion	...	7	1	...	...	2	...
Cystic...	8	83	6	...	6	24	...
Engorgement	84	230	5	1	...	3	...
Parasitic	...	1	1	...	...	2	...
Pleurisy	4	34	14	...	...	...	...
Pleuro-Pneumonia	...	2	3	...	...	...	...
Pneumonia	3	31	16	...	7	44	...
Tuberculosis	4	238	16	...	...	1	3
LIVER—							
Abscess	3	17	5	...	1	1	...
Cirrhosis	...	2	...	...	...	...	...
Congestion	1	2	1	...	...	...	...
Distomatosis	49	46	18	...	5	54	...
Engorgement	3	19	...	...	...	..	...
Tuberculosis	2	35	9	...	2	4	3
Cystic	8	32	2	...	9	21	...
HEAD—							
Abscesses	...	6	...	...	...	...	...
Foot-and-mouth Disease ...	1	26	30	...	...	...	...
Injuries...	...	2	...	...	...	...	...
BOWELS—							
Cattle plague	3	10	2	1	..	...	..
KIDNEY—							
Abscesses	...	1	...	...	..	...	...
Cystic	1	...	...	...	...	...	...
MAMMARY GLAND—							
Abscess	...	..	1	...	...	..	...
Tuberculosis	...	...	6	...	...	...	...
FRACTURES—							
Fetlocks	...	4	...	...	...	...	..
Legs	...	8	1	...	...	...	...
Ribs	...	6	...	1	...	...	...
Shoulder	...	1	...	...	...	...	...
Vertebræ	...	6	...	...	...	...	...
Pelvis	5	58	10	...	...	...	...
INJURIES—							
Dislocation, &c.	2	6	...	...	...	...	...
FEET—							
Foot-and-mouth disease ...	1	5	10	...	...	..	...
Injuries	1	4	...	...	...	...	...
ALL INTERNAL ORGANS—							
Cattle plague	171	289	82	14	...	...	...

During the year 35 cases of illicit slaughtering, 13 cases of exposing meat not slaughtered in accordance with Bye-laws (for sale), 5 cases of exposing meat unfit for human consumption, and 1 case of keeping goats within prescribed limits (presumably for slaughter), were dealt with by the Inspector of Illicit Slaughtering.

The report forms most interesting reading, and we are sure that the Municipality of Rangoon has never regretted the appointment, which was only made a few years ago, of a Veterinary Official to supervise meat inspection and the general enforcement of laws to guard the health and welfare of the animal population of the country.

SCIENTIFIC REPORTS ON THE INVESTIGATIONS OF THE IMPERIAL CANCER RESEARCH FUND; in two closely written volumes. By Dr. BASHFORD, the General Superintendent.

The authorities of the Imperial Cancer Research Fund have issued the outcome of the extensive investigations which they have made in connection with cancer.

In the introduction we are told that the term "cancer" is used to cover all forms of malignant new growth, and the author acknowledges the great help which he has received, amongst other sources, from members of the veterinary profession.

There is no doubt, since the research fund has been instituted, much greater interest has been taken to find out to what extent animals were subject to this fatal disease. Many thousands of inoculations were made and the result has been to produce very strong evidence against the infective nature of cancer.

In support of this we read in the report that "in the course of the past two years upwards of 900 inoculations of cancer have been made (in horses, dogs, cats and rats) in animals of the same species as that providing the tumour and in not one single instance has a tumour developed with any resemblance to the original growth. In the case of certain cancers 8,000 inoculations have been made with a success averaging from 1½ to 50 per cent. The negative result of inoculations in horses, dogs, cats and rats, together with the uniformly low percentage of success in mice, are very strong evidence against the infective nature of cancer; for they have been obtained under conditions most favourable to the establishment of an infective disease. We have had a number of healthy animals (horses, dogs, cats, rats and mice) in continuous contact with others of their species suffering from various forms of external and internal cancer, and in no case has a malignant new growth, traceable to association with an existing case, appeared sporadically among our normal animals. A considerable portion of the healthy animals have been old."

Some 8,000 mice were inoculated with malignant new growth and housed successively in cages which were not disinfected, whilst animals with rapidly growing and large sporadic tumours, were kept in succession in the same cages along with normal mice. Not a single sporadic tumour developed in consequence of leaving mice for a long period in what must have been veritable "cancer houses" in

a much higher degree than the reputed "cancer houses" of human experience.

One chapter in particular is of the greatest interest to veterinary surgeons; it is headed "A Comparison between the Transmission of an Infective Granuloma of the Dog and Carcinoma of the Mouse," and we shall on this account print an abstract in another column in next month's journal. It particularly deals with the infective venereal tumour which is so commonly met with in some breeds of dogs, especially the bull bitch; and the microscopical structures of this growth which has been respectively designated by various pathologists as a carcinoma, a round-cell sarcoma, a lympho-sarcoma, a papilloma, and a granuloma, is beautifully illustrated by four large plates.

The price of the report is 2s. 6d., and it is printed and published by Taylor and Francis, Red Lion Court, Fleet Street, E.C.

We have been requested to say that after the 1st October the address of the Paris Central Veterinary Medical Society will be No. 12, Rue de Seine, Paris, and that the meetings will be held on the first and third Thursdays of the month, at 3 p.m.

Books and Periodicals, &c., Received.

Buletinal Societatü de Scünte din Bueuresci; Recueil de Méd. Vét.; Fortschritte der Veterinär Hygiene; Journal of the Royal Army Medical Corps; Berliner Tierarztliche Wochenschrift; Ceylon Tropical Agriculturist; La Clinica Veterinaria; Cattle Tuberculosis (Sessions); Board of Agriculture Returns; Johns Hopkins Hospital Bulletin; Veterinary Physiology and Pharmacology (P. A. Fish); Transvaal Agricultural Journal; American Veterinary Review; Department of Agriculture (Canada); Revista de Medicina Veterinaria; Veterinary Record.

Communications, &c., Received.

Lieut. O'Rourke; Prof. Bradley; Mr. R. G. Linton; Mr. T. Hodgins; Mr. H. B. Eve; Mr. W. D. Blanchard; Mr. E. Livesey; Mr. T. Foulkes; Mr. Lewis Green.

Note.—All communications should be addressed to 8, Henrietta Street, Covent Garden, London, W.C. Telephone, 4646 Gerrard. Telegrams, "Baillière, London."

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements), should be addressed to the Editor.

Manuscript—preferably type-written—should be on one side only of paper, marked with full name of author.

Illustrations for reproduction should be in good black or dark brown on white paper or card.

Advertisements and all business matters relating to the Journal should be addressed to the publishers, Messrs. Baillière, Tindall and Cox.

All authors desiring reprints of their articles will be supplied with copies free of charge upon requesting same within a week of publication of the Journal.

PROFESSOR DR. HUTYRA.

President of the Executive Committee of the Eighth International Veterinary Congress, Buda-Pesth, 1905.